Stillwater
PGM
Resources

# EAST BOULDER MINE PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT

Prepared by

Montana Department of State Lands

U.S. Forest Service

Department of Health and Environmental Sciences

May 1992

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May 1992

Gallatin National Forest
Federal Building
Bozeman, MT 59715

Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Reader,

Enclosed is a copy of the final Environmental Impact Statement for Stillwater PGM Resources' proposed East Boulder project. The final includes the text from the draft, as revised by additional data and comments, as well as the comments and the responses to them. A summary of changes in the final text is presented in Chapter 1.

Following publication of this document, Stillwater PGM Resources' petition for a modification of ambient water quality for nitrates and other constituents will be heard before the Board of Health and Environmental Sciences. That hearing is scheduled for Wednesday, June 24, 1992, in Room C209 of the Cogswell Building (on the corner of Broadway and Sanders) in Helena. The agenda for the Board meeting will be mailed to the entire EIS mailing list. If you are not on the mailing list and wish to receive a copy of the agenda please contact Yolanda Fitzsimmons at 444-2545.

Following the Board meeting, the Board of Health will make a decision regarding the petition. That decision may be made the day of the hearing (June 24) or at the next regularly scheduled Board meeting (July 17). Following the Board's decision, the Gallatin National Forest (GNF) and the Department of State Lands (DSL) will prepare and publish a Record of Decision, which reflects the findings in this document as well as the Board decision. The DSL decision would also reflect the status of the Hard Rock Impact plan that is being prepared for Sweet Grass County. The GNF and DSL decision will be made soon after the Board decision. Final permits and authorizations would be granted by the agencies when Stillwater PGM Resources submits their reclamation bond.

The agencies (GNF, DSL and DHES) would like to thank everyone who participated in the development of our analyses of this project. Thank you, too, for the time you put into reviewing the documents and in attending public meetings. Your thoughtful well-articulated input helped us to frame and evaluate reasonable alternatives and to assure we had addressed your concerns with this project.

Sincerely,

Sherm Sollid

Sherm Sollid
Geologist/Project Coordinator
Gallatin National Forest

Sincerely,

Jo Stephen

Jo Stephen
Environmental Coordinator
Hard Rock Bureau
Reclamation Division

Enclosure

| Section | | | Page |
|---|---|---|---|
| LIST OF ABBREVIATIONS | | | L-1 |
| LIST OF UNITS | | | L-3 |
| GLOSSARY | | | G-1 |
| SUMMARY | | | S-1 |
| CHAPTER ONE: INTRODUCTION | | | 1-1 |
| | 1.1 | PROJECT LOCATION AND BACKGROUND | 1-1 |
| | 1.2 | PURPOSE AND NEED FOR ACTION | 1-3 |
| | 1.3 | THE EIS PROCESS | 1-3 |
| | 1.4 | AGENCY RESPONSIBILITIES AND REGULATORY AUTHORITY | 1-4 |
| | 1.5 | ISSUES AND CONCERNS | 1-9 |
| CHAPTER TWO: PROPOSAL, ALTERNATIVES, AND OTHER DEVELOPMENT ACTIVITIES | | | 2-1 |
| | 2.1 | DEVELOPMENT OF ALTERNATIVES | 2-1 |
| | 2.2 | ALTERNATIVE 1 - NO ACTION | 2-4 |
| | 2.3 | ALTERNATIVE 2 - PROPOSED ACTION | 2-6 |
| | 2.3.1 | Mining Plan and Methods | 2-11 |
| | 2.3.2 | Production | 2-14 |
| | 2.3.3 | Ore Processing | 2-16 |
| | 2.3.4 | Tailing Disposal Facility | 2-24 |
| | 2.3.5 | Waste Rock | 2-26 |
| | 2.3.6 | Mine Water Use and Management | 2-26 |
| | 2.3.7 | Subsidence and Landslides | 2-33 |
| | 2.3.8 | Energy Consumption and Source | 2-35 |
| | 2.3.9 | Roads | 2-35 |
| | 2.3.10 | Ore Handling | 2-37 |
| | 2.3.11 | Surface Equipment | 2-37 |
| | 2.3.12 | Surface Support Facilities | 2-37 |
| | 2.3.13 | Mine Utilities | 2-45 |
| | 2.3.14 | Security and Public Safety | 2-46 |
| | 2.3.15 | Sewage Disposal | 2-47 |
| | 2.3.16 | Solid Waste | 2-47 |
| | 2.3.17 | Fire Protection and Emergency Response | 2-47 |
| | 2.3.18 | Personnel | 2-48 |
| | 2.3.19 | Environmental Resources Management | 2-49 |
| | 2.3.20 | Project Closure and Reclamation | 2-51 |

| Section | | | Page |
|---|---|---|---|
| 2.4 | MODIFICATIONS TO THE PROPOSED ACTION - ALTERNATIVES 3, 4, 5 AND 6 | | 2-66 |
| | 2.4.1 | Alternative 3 - Tailing Impoundment Configuration | 2-66 |
| | 2.4.2 | Alternative 4 - Alternative Access Road/Power Line Alignments | 2-69 |
| | 2.4.3 | Alternative 5 - Power Supply Corridor Systems | 2-73 |
| | 2.4.4 | Alternative 6 - Water Treatment Methods | 2-77 |
| 2.5 | ALTERNATIVE 7 - PROPOSED ACTION WITH MODIFICATIONS | | 2-93 |
| | 2.5.1 | Mine Water Drainage | 2-94 |
| | 2.5.2 | Surface Water Control | 2-95 |
| | 2.5.3 | Groundwater Contamination | 2-95 |
| | 2.5.4 | East Boulder River | 2-96 |
| | 2.5.5 | Water Quality/Quantity Monitoring | 2-96 |
| | 2.5.6 | Reclamation | 2-97 |
| | 2.5.7 | Road Mitigations | 2-99 |
| | 2.5.8 | Waste Rock | 2-100 |
| | 2.5.9 | Recreation | 2-101 |
| | 2.5.10 | Soils | 2-101 |
| | 2.5.11 | Impoundment Stability | 2-101 |
| | 2.5.12 | Wildlife | 2-101 |
| | 2.5.13 | Wetlands | 2-104 |
| | 2.5.14 | Visuals | 2-104 |
| | 2.5.15 | Noise | 2-104 |
| | 2.5.16 | Health and Safety | 2-104 |
| | 2.5.17 | Placer Basin and Brownlee Creek | 2-105 |
| | 2.5.18 | Sewage Treatment | 2-105 |
| | 2.5.19 | Reagents | 2-107 |
| | 2.5.20 | Cultural Resources | 2-107 |
| | 2.5.21 | Summary Table of Plans | 2-107 |
| 2.6 | ALTERNATIVE 8 - TWIN PRODUCTION ADITS | | 2-107 |
| 2.7 | OTHER RELATED DEVELOPMENT ACTIVITIES | | 2-111 |
| | 2.7.1 | Projects of Concern Evaluated in this EIS (GNF) | 2-116 |
| | 2.7.2 | Projects of Concern Evaluated in this EIS (Custer National Forest) | 2-118 |
| | 2.7.3 | Projects of Concern not Evaluated in this EIS (GNF) | 2-119 |
| | 2.7.4 | Projects of Concern not Evaluated in this EIS (Custer National Forest) | 2-120 |
| 2.8 | AGENCIES' PREFERRED ALTERNATIVES | | 2-122 |
| CHAPTER THREE: AFFECTED ENVIRONMENT | | | 3-1 |
| 3.1 | CULTURAL RESOURCES | | 3-3 |
| 3.2 | SURFACE WATER | | 3-4 |

| Section | | | Page |
|---|---|---|---|
| | 3.2.1 | Description of Study Area Surface Waters | 3-4 |
| | 3.2.2 | Streamflow Characteristics | 3-7 |
| | 3.2.3 | Surface Water Quality | 3-9 |
| 3.3 | GROUNDWATER | | 3-13 |
| | 3.3.1 | Groundwater Occurrence | 3-14 |
| | 3.3.2 | Placer Basin Permit Area | 3-18 |
| | 3.3.3 | Groundwater Quality | 3-18 |
| 3.4 | SOILS | | 3-22 |
| | 3.4.1 | General Soil Conditions | 3-22 |
| | 3.4.2 | Soil Conditions at Proposed Sites of Disturbance | 3-22 |
| 3.5 | GEOLOGY | | 3-25 |
| | 3.5.1 | Geologic History | 3-26 |
| | 3.5.2 | Regional Geology | 3-27 |
| | 3.5.3 | Stillwater Complex Geology | 3-27 |
| | 3.5.4 | Structural Geology | 3-29 |
| | 3.5.5 | Surficial Geology | 3-30 |
| 3.6 | WILDLIFE | | 3-30 |
| | 3.6.1 | Habitat Types | 3-30 |
| | 3.6.2 | Important Wildlife Species | 3-33 |
| | 3.6.3 | Threatened, Endangered, and Sensitive Species | 3-40 |
| 3.7 | AQUATIC ECOLOGY AND FISHERIES | | 3-44 |
| | 3.7.1 | Stream Habitat | 3-44 |
| | 3.7.2 | Periphyton and Benthic Macroinvertebrates | 3-45 |
| | 3.7.3 | Fisheries | 3-46 |
| | 3.7.4 | Species of Special Concern | 3-47 |
| 3.8 | VEGETATION, WETLANDS, AND TIMBER RESOURCES | | 3-47 |
| | 3.8.1 | General Vegetation Conditions | 3-47 |
| | 3.8.2 | Habitat Types and Plant Communities | 3-49 |
| | 3.8.3 | Sensitive Species | 3-56 |
| | 3.8.4 | Wetlands | 3-58 |
| | 3.8.5 | Timber | 3-62 |
| | 3.8.6 | Noxious Weeds | 3-62 |

| Section | | | Page |
|---|---|---|---|
| 3.9 | AIR QUALITY | | 3-63 |
| | 3.9.1 | Climatology and Meteorology | 3-63 |
| 3.10 | ROADS AND TRANSPORTATION | | 3-68 |
| | 3.10.1 | Roads | 3-68 |
| | 3.10.2 | Bridges | 3-73 |
| | 3.10.3 | Other Transportation | 3-73 |
| 3.11 | LAND USE | | 3-73 |
| 3.12 | VISUAL RESOURCES | | 3-78 |
| 3.13 | RECREATION AND WILDERNESS | | 3-85 |
| 3.14 | SOCIOECONOMICS | | 3-94 |
| | 3.14.1 | Local Economy and Employment | 3-94 |
| | 3.14.2 | Population | 3-99 |
| | 3.14.3 | Housing | 3-101 |
| | 3.14.4 | Local Government Facilities and Services | 3-102 |
| | 3.14.5 | Local Government Fiscal Conditions | 3-127 |
| | 3.14.6 | Attitudes, Opinions and Lifestyles | 3-144 |
| 3.15 | NOISE | | 3-146 |
| CHAPTER FOUR: ENVIRONMENTAL CONSEQUENCES | | | 4-1 |
| 4.1 | CULTURAL RESOURCES | | 4-4 |
| | 4.1.1 | Alternative 1 - No Action | 4-4 |
| | 4.1.2 | Alternative 2 - Proposed Action | 4-4 |
| | 4.1.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-6 |
| | 4.1.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-7 |
| | 4.1.5 | Alternative 5 - Power Supply Corridor Systems | 4-7 |
| | 4.1.6 | Alternative 6 - Water Treatment Alternatives | 4-7 |
| | 4.1.7 | Alternative 7 - Proposed Action with Modifications | 4-7 |
| | 4.1.8 | Alternative 8 - Twin Production Adits | 4-8 |
| | 4.1.9 | Cumulative Impacts | 4-8 |
| 4.2 | SURFACE WATER RESOURCES | | 4-8 |
| | 4.2.1 | Alternative 1 - No Action | 4-8 |
| | 4.2.2 | Alternative 2 - Proposed Action | 4-8 |
| | 4.2.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-20 |
| | 4.2.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-21 |
| | 4.2.5 | Alternative 5 - Power Supply Corridor Systems | 4-21 |
| | 4.2.6 | Alternative 6 - Water Treatment Alternatives | 4-21 |
| | 4.2.7 | Alternative 7 -Proposed Action with Modifications | 4-26 |

| Section | | | Page |
|---|---|---|---|
| | 4.2.8 | Alternative 8 - Twin Production Adits | 4-28 |
| | 4.2.9 | Cumulative Impacts | 4-30 |
| 4.3 | GROUNDWATER | | 4-30 |
| | 4.3.1 | Alternative 1 - No Action | 4-30 |
| | 4.3.2 | Alternative 2 - Proposed Action | 4-31 |
| | 4.3.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-37 |
| | 4.3.4 | Alternative 4 - Access Roads | 4-37 |
| | 4.3.5 | Alternative 5 - Power Supply Corridor Systems | 4-37 |
| | 4.3.6 | Alternative 6 - Water Treatment Alternatives | 4-37 |
| | 4.3.7 | Alternative 7 - Proposed Action with Modifications | 4-37 |
| | 4.3.8 | Alternative 8 - Twin Production Adits | 4-38 |
| | 4.3.9 | Cumulative Impacts | 4-38 |
| 4.4 | SOILS | | 4-39 |
| | 4.4.1 | Alternative 1 - No Action | 4-39 |
| | 4.4.2 | Alternative 2 - Proposed Action | 4-40 |
| | 4.4.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-40 |
| | 4.4.4 | Alternative 4 - Alternative Access Roads and Power Line Alignments | 4-41 |
| | 4.4.5 | Alternative 5 - Power Supply Corridor Systems | 4-41 |
| | 4.4.6 | Alternative 6 - Water Treatment Alternatives | 4-41 |
| | 4.4.7 | Alternative 7 - Proposed Action with Modifications | 4-41 |
| | 4.4.8 | Alternative 8 - Twin Production Adits | 4-42 |
| | 4.4.9 | Cumulative Impacts | 4-42 |
| 4.5 | GEOLOGY AND GEOTECHNICAL CONDITIONS | | 4-42 |
| | 4.5.1 | Alternative 1 - No Action | 4-42 |
| | 4.5.2 | Alternative 2 - Proposed Action | 4-43 |
| | 4.5.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-45 |
| | 4.5.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-45 |
| | 4.5.5 | Alternative 5 - Power Supply Corridor Systems | 4-45 |
| | 4.5.6 | Alternative 6 - Water Treatment Alternatives | 4-45 |
| | 4.5.7 | Alternative 7 - Proposed Action with Modifications | 4-46 |
| | 4.5.8 | Alternative 8 - Twin Production Adits | 4-46 |
| | 4.5.9 | Cumulative Impacts | 4-47 |
| | 4.5.10 | Geologic Hazards | 4-47 |
| | 4.5.11 | Other Economic Resources | 4-48 |
| 4.6 | WILDLIFE | | 4-48 |
| | 4.6.1 | Alternative 1 - No Action | 4-48 |
| | 4.6.2 | Alternative 2 - Proposed Action | 4-49 |
| | 4.6.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-57 |
| | 4.6.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-57 |

Section | Page

4.6.5 Alternative 5 - Power Supply Corridor Systems 4-57
4.6.6 Alternative 6 - Water Treatment Alternatives 4-58
4.6.7 Alternative 7 - Proposed Action with Modifications 4-58
4.6.8 Alternative 8 - Twin Production Adits 4-59
4.6.9 Cumulative Impacts 4-59

4.7 AQUATIC ECOLOGY AND FISHERIES 4-61

4.7.1 Alternative 1 - No Action 4-61
4.7.2 Alternative 2 - Proposed Action 4-61
4.7.3 Alternative 3 - Modified Tailing Impoundment Configuration 4-63
4.7.4 Alternative 4 - Alternative Access Road/Power Line Alignments 4-63
4.7.5 Alternative 5 - Power Supply Corridor Systems 4-64
4.7.6 Alternative 6 - Water Treatment Methods 4-64
4.7.7 Alternative 7 - Proposed Action with Modifications 4-64
4.7.8 Alternative 8 - Twin Production Adits 4-64
4.7.9 Cumulative Impacts 4-65

4.8 VEGETATION, WETLANDS, AND TIMBER RESOURCES 4-65

4.8.1 Alternative 1 - No Action 4-65
4.8.2 Alternative 2 - Proposed Action 4-66
4.8.3 Alternative 3 - Modified Tailing Impoundment Configuration 4-69
4.8.4 Alternative 4 - Alternative Access Road/Power Line Alignments 4-69
4.8.5 Alternative 5 - Power Supply Corridor Systems 4-69
4.8.6 Alternative 6 - Water Treatment Alternatives 4-70
4.8.7 Alternative 7 - Proposed Action with Modifications 4-70
4.8.8 Alternative 8 - Twin Production Adits 4-71
4.8.9 Cumulative Impacts 4-71

4.9 AIR QUALITY 4-71

4.9.1 Alternative 1 - No Action 4-71
4.9.2 Alternative 2 - Proposed Action 4-72
4.9.3 Alternative 3 - Modified Tailing Impoundment Configuration 4-74
4.9.4 Alternative 4 - Alternative Access Road/Power Line Alignments 4-74
4.9.5 Alternative 5 - Power Supply Corridor Systems 4-74
4.9.6 Alternative 6 - Water Treatment Alternatives 4-74
4.9.7 Alternative 7 - Proposed Action with Modifications 4-75
4.9.8 Alternative 8 - Twin Production Adits 4-75
4.9.9 Cumulative Impacts 4-75

4.10 TRANSPORTATION 4-75

4.10.1 Alternative 1 - No Action 4-76
4.10.2 Alternative 2 - Proposed Action 4-76
4.10.3 Alternative 3 - Modified Tailing Impoundment Configuration 4-77

| Section | | Page |
|---|---|---|
| 4.10.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-78 |
| 4.10.5 | Alternative 5 - Power Supply Corridor Systems | 4-78 |
| 4.10.6 | Alternative 6 - Water Treatment Alternatives | 4-79 |
| 4.10.7 | Alternative 7 - Proposed Action with Modifications | 4-79 |
| 4.10.8 | Alternative 8 - Twin Production Adits | 4-80 |
| 4.10.9 | Cumulative Impacts | 4-80 |
| 4.11 | LAND USE | 4-80 |
| 4.11.1 | Alternative 1 - No Action | 4-80 |
| 4.11.2 | Alternative 2 - Proposed Action | 4-80 |
| 4.11.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-81 |
| 4.11.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-81 |
| 4.11.5 | Alternative 5 - Power Supply Corridor Systems | 4-82 |
| 4.11.6 | Alternative 6 - Water Treatment Alternatives | 4-82 |
| 4.11.7 | Alternative 7 - Proposed Action with Modifications | 4-82 |
| 4.11.8 | Alternative 8 - Twin Production Adits | 4-82 |
| 4.11.9 | Cumulative Impacts | 4-82 |
| 4.12 | VISUAL RESOURCES | 4-82 |
| 4.12.1 | Alternative 1 - No Action | 4-82 |
| 4.12.2 | Alternative 2 - Proposed Action | 4-83 |
| 4.12.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-84 |
| 4.12.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-84 |
| 4.12.5 | Alternative 5 - Power Supply Corridor Systems | 4-84 |
| 4.12.6 | Alternative 6 - Water Treatment Alternatives | 4-84 |
| 4.12.7 | Alternative 7 - Proposed Action with Modifications | 4-84 |
| 4.12.8 | Alternative 8 - Twin Production Adits | 4-85 |
| 4.12.9 | Cumulative Impacts | 4-85 |
| 4.13 | RECREATION AND WILDERNESS | 4-85 |
| 4.13.1 | Alternative 1 - No Action | 4-85 |
| 4.13.2 | Alternative 2 - Proposed Action | 4-86 |
| 4.13.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-88 |
| 4.13.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-88 |
| 4.13.5 | Alternative 5 - Power Supply Corridor Systems | 4-88 |
| 4.13.6 | Alternative 6 - Water Treatment Alternatives | 4-88 |
| 4.13.7 | Alternative 7 - Proposed Action with Modifications | 4-89 |
| 4.13.8 | Alternative 8 - Twin Production Adits | 4-89 |
| 4.13.9 | Cumulative Impacts | 4-89 |
| 4.14 | SOCIOECONOMICS | 4-89 |
| 4.14.1 | Alternative 1 - No Action | 4-92 |
| 4.14.2 | Alternative 2 - Proposed Action | 4-93 |

| Section | | Page |
|---|---|---|
| 4.14.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-132 |
| 4.14.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-132 |
| 4.14.5 | Alternative 5 - Power Supply Corridor Systems | 4-133 |
| 4.14.6 | Alternative 6 - Water Treatment Alternatives | 4-133 |
| 4.14.7 | Alternative 7 - Proposed Action Modifications | 4-133 |
| 4.14.8 | Alternative 8 - Twin Production Adits | 4-133 |
| 4.14.9 | Cumulative Impacts | 4-133 |
| 4.15 | NOISE | 4-133 |
| 4.15.1 | Alternative 1 - No Action | 4-133 |
| 4.15.2 | Alternative 2 - Proposed Action | 4-134 |
| 4.15.3 | Alternative 3 - Modified Tailing Impoundment Configuration | 4-135 |
| 4.15.4 | Alternative 4 - Alternative Access Road/Power Line Alignments | 4-136 |
| 4.15.5 | Alternative 5 - Power Supply Corridor Systems | 4-136 |
| 4.15.6 | Alternative 6 - Water Treatment Alternatives | 4-136 |
| 4.15.7 | Alternative 7 - Proposed Action with Modifications | 4-136 |
| 4.15.8 | Alternative 8 - Twin Production Adits | 4-137 |
| 4.15.9 | Cumulative Impacts | 4-137 |
| 4.16 | ENVIRONMENTAL IMPACTS BY ALTERNATIVE | 4-138 |
| 4.16.1 | Impacts Summary: Alternative 1 - No Action | 4-138 |
| 4.16.2 | Impacts Summary: Alternative 2 - Proposed Action | 4-139 |
| 4.16.3 | Impacts Summary: Alternative 3 - Modified Tailing Impoundment Configuration | 4-143 |
| 4.16.4 | Impacts Summary: Alternative 4 - Alternative Access Road/Power Line Alignments | 4-143 |
| 4.16.5 | Impacts Summary: Alternative 5 - Power Supply Corridor Systems | 4-144 |
| 4.16.6 | Impacts Summary: Alternative 6 - Water Treatment Alternatives | 4-145 |
| 4.16.7 | Impacts Summary: Alternative 7 - Proposed Action with Modifications | 4-146 |
| 4.16.8 | Impacts Summary: Alternative 8 - Twin Production Adits | 4-146 |
| 4.16.9 | Impacts Summary: Cumulative Impacts | 4-147 |
| 4.17 | IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES | 4-148 |
| 4.18 | RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM RESOURCE PRODUCTIVITY | 4-149 |
| CHAPTER FIVE: COMPARISON OF ALTERNATIVES | | 5-1 |
| 5.1 | CULTURAL RESOURCES | 5-1 |
| 5.2 | SURFACE WATER RESOURCES | 5-1 |
| 5.3 | GROUNDWATER | 5-4 |
| 5.4 | SOILS | 5-5 |

| Section | | Page |
|---|---|---|
| 5.5 | GEOLOGY AND GEOTECHNICAL CONDITIONS | 5-5 |
| 5.6 | WILDLIFE | 5-6 |
| 5.7 | AQUATIC BIOLOGY | 5-7 |
| 5.8 | VEGETATION, WETLANDS, AND TIMBER RESOURCES | 5-7 |
| 5.9 | AIR QUALITY | 5-8 |
| 5.10 | TRANSPORTATION | 5-9 |
| 5.11 | LAND USE | 5-12 |
| 5.12 | VISUAL RESOURCES | 5-12 |
| 5.13 | RECREATION AND WILDERNESS | 5-13 |
| 5.14 | SOCIOECONOMICS | 5-14 |
| 5.15 | NOISE | 5-14 |
| CHAPTER SIX: | CONSULTATION AND COORDINATION | 6-1 |
| 6.1 | COMMENTS AND RESPONSES TO THE DRAFT EIS | 6-2 |
| 6.1.1 | Listing of Commentors | 6-2 |
| 6.1.2 | Comment Letters and Transcriptions | 6-3 |
| 6.1.3 | Responses to Comments | 6-42 |
| 6.2 | DISTRIBUTION AND REVIEW | 6-122 |
| 6.2.1 | Federal, State, and Local Agencies | 6-122 |
| 6.2.2 | Federal, State, and Local Officials | 6-125 |
| 6.2.3 | Individuals, Businesses, and Organizations | 6-127 |
| 6.3 | EIS REPOSITORY | 6-145 |
| 6.4 | ADDITIONAL COPIES | 6-145 |
| CHAPTER SEVEN: | LIST OF PREPARERS | 7-1 |
| CHAPTER EIGHT: | REFERENCES | 8-1 |

| Section | Page |
|---|---|

LIST OF APPENDIXES

APPENDIX A RESPONSES TO PUBLIC CONCERNS
APPENDIX B JACKPINE PROJECT EXPLORATION ADIT DECISION NOTICE AND FINDING OF NO SIGNIFICANT IMPACT AND SETTLEMENT AGREEMENT
APPENDIX C REVISED PRELIMINARY DETERMINATION ON AIR QUALITY PERMIT APPLICATION
APPENDIX D BIOLOGICAL ASSESSMENT

Page

LIST OF TABLES


| | | |
|---|---|---|
| TABLE 1.4-1 | PERMITS, LICENSES, AND APPROVALS POTENTIALLY REQUIRED FOR THE EAST BOULDER MINE PROJECT | 1-5 |
| TABLE 1.5-1 | ISSUES AND CONCERNS, EAST BOULDER MINE PROJECT | 1-11 |
| TABLE 2.1-1 | SUMMARY TABLE OF ALTERNATIVES | 2-5 |
| TABLE 2.3-1 | SITE SUMMARY OF PROJECT ACREAGES | 2-11 |
| TABLE 2.3-2 | FLOTATION REAGENTS | 2-19 |
| TABLE 2.3-3 | SUMMARY OF TAILING IMPOUNDMENT CHARACTERISTICS | 2-25 |
| TABLE 2.3-4 | TAILING IMPOUNDMENT STABILITY ANALYSIS | 2-27 |
| TABLE 2.3-5 | ESTIMATED MINE WASTE ROCK PRODUCTION SCHEDULE | 2-28 |
| TABLE 2.3-6A | ESTIMATED MINE DISCHARGE WATER QUALITY BEFORE TREATMENT | 2-32 |
| TABLE 2.3-6B | REQUESTED CHANGE IN WATER QUALITY LIMITS | 2-34 |
| TABLE 2.3-7 | UNDERGROUND AND SURFACE EQUIPMENT SUMMARY | 2-38 |
| TABLE 2.3-8 | PROPOSED MINE FACILITY LOCATIONS | 2-39 |
| TABLE 2.3-9 | TRAFFIC PROJECTIONS | 2-49 |
| TABLE 2.3-10A | LOW ELEVATION REVEGETATION MIXTURE SEEDING RATES | 2-53 |
| TABLE 2.3-10B | LOW ELEVATION REVEGETATION MIXTURE PLANTING RATES | 2-54 |
| TABLE 2.3-11 | UPPER ELEVATION REVEGETATION MIXTURE SEEDING RATES | 2-55 |
| TABLE 2.3-12 | SCREE SLOPE REVEGETATION MIXTURE SEEDING RATES | 2-56 |
| TABLE 2.3-13 | INTERIM REVEGETATION MIXTURE SEEDING RATES | 2-57 |
| TABLE 2.3-14 | CHEMICAL ANALYSIS OF SMC MINE WASTE ROCK LEACHATE | 2-64 |
| TABLE 2.3-15 | METAL ANALYSES OF SMC MINE WASTE AND TAILING | 2-65 |
| TABLE 2.4-1 | COMPARISON OF CONVENTIONAL AND ADVANCED WATER TREATMENT OPTIONS - EAST BOULDER MINE | 2-92 |
| TABLE 2.5-1 | SUMMARY TABLE OF PLANS | 2-107 |
| TABLE 2.8-1 | COMPARISON OF WATER TREATMENT ALTERNATIVE ACHIEVING ALLOWABLE CONCENTRATIONS | 2-124 |
| TABLE 3.2-1 | AMBIENT AVERAGE SURFACE WATER QUALITY DATA | 3-11 |
| TABLE 3.3-1 | WELL COMPLETION SPECIFICATIONS | 3-15 |
| TABLE 3.3-2 | WATER SUPPLY WELLS | 3-16 |
| TABLE 3.3-3 | GROUNDWATER QUALITY OF SELECTED WELLS IN THE STUDY AREA | 3-19 |
| TABLE 3.6-1 | APPROXIMATE AREA OF WILDLIFE HABITAT TYPES IN PERMIT AREAS | 3-33 |
| TABLE 3.6-3 | ENDANGERED, THREATENED, AND SENSITIVE WILDLIFE SPECIES KNOWN OR POTENTIALLY OCCURRING IN THE STUDY AREA | 3-41 |
| TABLE 3.8-1 | HABITAT TYPES THAT OCCUR IN THE EAST BOULDER RIVER | |

| | | Page |
|---|---|---|
| | STUDY AREA | 3-50 |
| TABLE 3.8-2 | WETLANDS VEGETATION | 3-52 |
| TABLE 3.9-1 | MAXIMUM AND AVERAGE TSP AND PM-10 CONCENTRATIONS FOR THE PROJECT AREA | 3-64 |
| TABLE 3.9-2 | MONTANA AND NATIONAL AIR QUALITY STANDARDS | 3-65 |
| TABLE 3.9-3 | MEAN, MAXIMUM, AND AVERAGE MONTHLY TEMPERATURES FOR THE PROJECT AREA | 3-66 |
| TABLE 3.9-4 | PRECIPITATION TOTALS MEASURED AT THE PROJECT AREA | 3-67 |
| TABLE 3.9-5 | AVERAGE MONTHLY WIND SPEED AND DIRECTION FOR THE PROJECT AREA | 3-70 |
| TABLE 3.9-6 | PERCENT OCCURRENCE OF STABILITY CATEGORIES WITHIN PROJECT AREA, 1981-1982 | 3-71 |
| TABLE 3.10-1 | MAJOR ROAD ACCESS | 3-72 |
| TABLE 3.10-2 | BRIDGES ALONG FAS 298 AND SG 31 | 3-74 |
| TABLE 3.11-1 | LAND USE IN SWEET GRASS COUNTY | 3-76 |
| TABLE 3.11-2 | LAND OWNERSHIP IN SWEET GRASS COUNTY | 3-77 |
| TABLE 3.11-3 | MANAGEMENT AREAS AFFECTED | 3-80 |
| TABLE 3.12-1 | VISUAL QUALITY OBJECTIVES | 3-81 |
| TABLE 3.13-1 | RECREATIONAL USE OPPORTUNITIES IN PROJECT VICINITY | 3-87 |
| TABLE 3.13-2 | ESTIMATE OF RECREATION VISITOR DAYS BY ACTIVITY FOR THE BIG TIMBER RANGER DISTRICT | 3-90 |
| TABLE 3.13-3 | RECREATION OPPORTUNITY SPECTRUM CLASSES | 3-91 |
| TABLE 3.13-4 | ELK AND DEER HUNTER AND HARVEST STATISTICS FOR HUNTING DISTRICT 560 | 3-95 |
| TABLE 3.14-1 | SWEET GRASS COUNTY EMPLOYMENT BY PLACE OF WORK | 3-96 |
| TABLE 3.14-2 | SWEET GRASS COUNTY EARNINGS (1980-1988) | 3-97 |
| TABLE 3.14-3 | SWEET GRASS COUNTY LABOR FORCE, EMPLOYMENT BY PLACE OF RESIDENCE, UNEMPLOYMENT, AND COUNTY AND STATE UNEMPLOYMENT RATES (1980-1989) | 3-98 |
| TABLE 3.14-4 | SWEET GRASS COUNTY POPULATION PROFILE, 1980-1990 | 3-100 |
| TABLE 3.14-5 | PERSONNEL EMPLOYED AND ALLOCATION OF TIME BY FUND, CITY OF BIG TIMBER | 3-111 |
| TABLE 3.14-6 | INVENTORY OF VEHICLES AND EQUIPMENT WITH ALLOCATION OF COSTS BY FUND, CITY OF BIG TIMBER | 3-112 |
| TABLE 3.14-7 | SCHOOL ENROLLMENT, SCHOOL YEARS 1980-81 TO 1988-89, SWEET GRASS COUNTY | 3-122 |
| TABLE 3.14-8 | CLASS SIZES REQUIRED FOR ACCREDITATION, MONTANA BOARD OF PUBLIC EDUCATION | 3-123 |
| TABLE 3.14-9 | ENROLLMENT BY GRADE, 1984-85 TO 1990-91, BIG TIMBER GRADE SCHOOL | 3-124 |
| TABLE 3.14-10 | ENROLLMENT BY GRADE, 1984-85 TO 1990-91, SWEET GRASS COUNTY HIGH SCHOOL | 3-124 |
| TABLE 3.14-11 | AVAILABLE CAPACITY BY GRADE, 1990-91, | |

| | | Page |
|---|---|---|
| | BIG TIMBER GRADE SCHOOL | 3-126 |
| TABLE 3.14-12 | ENROLLMENT BY GRADE, 1984-85 TO 1990-91, MCLEOD ELEMENTARY SCHOOL | 3-128 |
| TABLE 3.14-13 | TAXABLE VALUE, 1973 TO 1990, SWEET GRASS COUNTY AND CITY OF BIG TIMBER | 3-129 |
| TABLE 3.14-14 | MARKET VALUE AND TAXABLE VALUE BY CATEGORY, 1988 TO 1990, SWEET GRASS COUNTY | 3-131 |
| TABLE 3.14-15 | APPROPRIATED EXPENDITURES, FY 1989 TO FY 1991, SWEET GRASS COUNTY | 3-132 |
| TABLE 3.14-16 | BUDGETED REVENUES, FY 1989 TO FY 1991, SWEET GRASS COUNTY | 3-134 |
| TABLE 3.14-17 | APPROPRIATED EXPENDITURES, FY 1989 TO FY 1991, CITY OF BIG TIMBER | 3-136 |
| TABLE 3.14-18 | BUDGETED REVENUES, FY 1989 TO FY 1991, CITY OF BIG TIMBER | 3-137 |
| TABLE 3.14-19 | EXPENDITURE APPROPRIATIONS, FY 1989 TO FY 1991, BIG TIMBER GRADE SCHOOL | 3-139 |
| TABLE 3.14-20 | ESTIMATED REVENUES, FY 1989 TO FY 1991, BIG TIMBER GRADE SCHOOL | 3-140 |
| TABLE 3.14-21 | EXPENDITURE APPROPRIATIONS, FY 1989 TO FY 1991, MCLEOD ELEMENTARY SCHOOL | 3-141 |
| TABLE 3.14-22 | ESTIMATED REVENUES, FY 1989 TO FY 1991, MCLEOD ELEMENTARY SCHOOL | 3-141 |
| TABLE 3.14-23 | EXPENDITURE APPROPRIATIONS, FY 1989 TO FY 1991, SWEET GRASS COUNTY HIGH SCHOOL | 3-142 |
| TABLE 3.14-24 | ESTIMATED REVENUES, FY 1989 TO FY 1991, SWEET GRASS COUNTY HIGH SCHOOL | 3-143 |
| TABLE 3.15-1 | AMBIENT NOISE LEVELS MEASURED IN THE PROJECT AREA | 3-147 |
| TABLE 3.15-2 | YEARLY AVERAGE EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY | 3-148 |
| TABLE 4.2-1 | ESTIMATED SURFACE WATER QUALITY RESULTING FROM GROUNDWATER DISCHARGE OF MINE WATER TO THE EAST BOULDER RIVER | 4-13 |
| TABLE 4.2-2 | ESTIMATED SURFACE WATER QUALITY RESULTING FROM DIRECT DISCHARGE OF MINE WATER TO THE EAST BOULDER RIVER | 4-14 |
| TABLE 4.2-6a | ESTIMATED SURFACE WATER QUALITY RESULTING FROM GROUNDWATER DISCHARGE OF MINE WATER TO THE EAST BOULDER RIVER - TREATMENT ALTERNATIVE 6A | 4-23 |
| TABLE 4.2-6b | ESTIMATED SURFACE WATER QUALITY RESULTING FROM GROUNDWATER DISCHARGE OF MINE WATER TO THE EAST BOULDER RIVER - TREATMENT ALTERNATIVE 6B | 4-24 |
| TABLE 4.2-6c | ESTIMATED SURFACE WATER QUALITY RESULTING | |

| | | Page |
|---|---|---|
| | FROM GROUNDWATER DISCHARGE OF MINE WATER TO THE EAST BOULDER RIVER - TREATMENT ALTERNATIVE 6C | 4-25 |
| TABLE 4.2-7 | SUMMARY OF IMPACTS TO SURFACE WATER RESOURCES, ALTERNATIVE 7 - PROPOSED ACTION WITH MODIFICATIONS | 4-29 |
| TABLE 4.3-1 | AMBIENT GROUNDWATER QUALITY | 4-35 |
| TABLE 4.6-1 | EAST BOULDER MINE ELK HABITAT EFFECTIVENESS INDEX, ALL ROADS OPEN | 4-52 |
| TABLE 4.14-1 | EAST BOULDER PROJECT: QUARTERLY CONSTRUCTION AND OPERATIONS IN YEAR 1 | 4-93 |
| TABLE 4.14-2 | EAST BOULDER PROJECT: ANNUAL AVERAGE CONSTRUCTION AND OPERATIONS EMPLOYMENT | 4-94 |
| TABLE 4.14-3 | EAST BOULDER PROJECT: IN-MIGRANT POPULATION AND SCHOOL-AGE CHILDREN, BY LOCATION | 4-99 |
| TABLE 4.14-4 | EAST BOULDER PROJECT: ESTIMATED ANNUAL PAYROLL FOR DIRECT PROJECT EMPLOYMENT | 4-100 |
| TABLE 4.14-5 | EAST BOULDER PROJECT: ESTIMATED TOTAL ANNUAL EARNINGS FOR INDIRECT EMPLOYMENT GENERATED BY THE PROJECT | 4-100 |
| TABLE 4.14-6 | EAST BOULDER PROJECT: IN-MIGRANT WORKER HOUSING NEEDS IN BIG TIMBER AND SWEET GRASS COUNTY | 4-102 |
| TABLE 4.14-7 | EAST BOULDER PROJECT: ESTIMATED DIRECT PROPERTY TAX REVENUES | 4-120 |
| TABLE 4.14-8 | EAST BOULDER PROJECT: ESTIMATED METAL MINES LICENSE TAX REVENUES TO SWEET GRASS COUNTY | 4-124 |
| TABLE 4.15-1 | NOISE LEVELS ASSOCIATED WITH CONSTRUCTION EQUIPMENT | 4-135 |
| TABLE 5-1 | SUMMARY OF EFFECTS FOR THE EAST BOULDER MINE PROJECT ALTERNATIVES | 5-2 |
| TABLE 5.2-1 | PREDICTED EAST BOULDER RIVER WATER QUALITY CONCENTRATIONS FOR PARAMETERS IN SPGMR PETITION | 5-3 |
| TABLE 5.10-1 | EVALUATION OF ROAD ALTERNATIVES | 5-10 |
| TABLE 5.10-2 | LAND CATEGORY RATINGS | 5-11 |

Section Page

LIST OF FIGURES


| | | |
|---|---|---|
| FIGURE 1.1-1 | VICINITY MAP | 1-2 |
| FIGURE 2.2-1 | JACKPINE EA FACILITIES PLAN | 2-7 |
| FIGURE 2.3-1 | GEOLOGY OF THE STILLWATER COMPLEX | 2-8 |
| FIGURE 2.3-2 | PROPOSED PROJECT FACILITIES PLAN | 2-9 |
| FIGURE 2.3-3 | PROJECT PERMIT AREA | 2-10 |
| FIGURE 2.3-4 | BROWNLEE CREEK ADIT SITE | 2-12 |
| FIGURE 2.3-5 | FROG POND ADIT SITE | 2-13 |
| FIGURE 2.3-6 | TYPICAL CUT AND FILL STOPE | 2-15 |
| FIGURE 2.3-7 | MILL FLOW SHEET | 2-17 |
| FIGURE 2.3-8 | WATER BALANCE | 2-31 |
| FIGURE 2.4-1 | EAST BOULDER TAILING POND | 2-68 |
| FIGURE 2.4-2 | ROAD ALTERNATIVES | 2-70 |
| FIGURE 2.4-3 | POWERLINE AND ROAD CORRIDORS | 2-75 |
| FIGURE 2.4-4 | ALTERNATIVE 6A1 WASTEWATER TREATMENT FACILITY | 2-80 |
| FIGURE 2.4-5 | ALTERNATIVE 6A2 WASTEWATER TREATMENT FACILITY | 2-83 |
| FIGURE 2.4-6 | ALTERNATIVE 6B INTERMEDIATE TREATMENT | 2-85 |
| FIGURE 2.4-7 | ALTERNATIVE 6C SUSPENDED SOLIDS REMOVAL | 2-89 |
| FIGURE 2.5-1 | PROPOSED PROJECT POTENTIAL EXPANSION AREA | 2-106 |
| FIGURE 2.6-1 | RELATED DEVELOPMENT ACTIVITIES | 2-109 |
| FIGURE 2.6-2 | OTHER DEVELOPMENT ACTIVITIES | 2-111 |
| FIGURE 2.7-1 | RELATED DEVELOPMENT ACTIVITIES | 2-113 |
| FIGURE 2.7-2 | OTHER DEVELOPMENT ACTIVITIES | 2-114 |
| FIGURE 3.2-1 | EAST BOULDER DRAINAGE BASINS | 3-5 |
| FIGURE 3.2-2 | HYDROLOGIC MONITORING SITES | 3-6 |
| FIGURE 3.2-3 | DELINEATED ½ PROBABLE MAXIMUM FLOODPLAN | 3-10 |
| FIGURE 3.3-1 | TAILINGS IMPOUNDMENT AREA CROSS-SECTION | 3-17 |
| FIGURE 3.4-1 | GENERAL ELEVATION/SOIL RELATIONSHIPS IN THE EAST BOULDER PERMIT AREA | 3-23 |
| FIGURE 3.6-1 | PROJECT SPECIFIC BIOLOGICAL FIELD STUDY AREAS | 3-31 |
| FIGURE 3.6-2 | ELK CONCENTRATED USE AREAS (SPRING/SUMMER/FALL) | 3-34 |
| FIGURE 3.6-3 | ELK CONCENTRATED USE AREAS (WINTER) | 3-35 |
| FIGURE 3.6-4 | MULE DEER CONCENTRATED USE AREAS (WINTER) | 3-37 |
| FIGURE 3.8-1 | GENERAL ELEVATION/VEGETATION RELATIONSHIPS IN THE EAST BOULDER PERMIT AREA | 3-48 |
| FIGURE 3.8-2 | CLAYTONIA LANCEOLATA VAR. FLAVA | 3-57 |
| FIGURE 3.8-3 | WETLANDS AND WATER FEATURES | 3-60 |
| FIGURE 3.9-1 | EAST BOULDER WINDROSE 1989 | 3-69 |
| FIGURE 3.11-1 | FOREST SERVICE MANAGEMENT AREAS IN STUDY AREA | 3-79 |
| FIGURE 3.12-1 | VISUAL QUALITY CLASSIFICATIONS OF STUDY AREA | 3-82 |
| FIGURE 3.12-2 | VISUAL ABSORPTION CAPABILITY | 3-84 |
| FIGURE 3.13-1 | RECREATION SITES | 3-86 |
| FIGURE 3.13-2 | ROADLESS AREA INVENTORY | 3-93 |
| FIGURE 4.6-1 | ELK HEI SUBCOMPACTMENTS | 4-53 |

# LIST OF ABBREVIATIONS AND UNITS OF MEASURE

| | |
|---|---|
| ADT | Average Daily Traffic |
| AMP | Allotment Management Plan |
| ANB | Average Number Belonging |
| AQB | Air Quality Bureau |
| ARM | Administrative Rules of Montana |
| BACT | Best Available Control Technology |
| BEA | Bureau of Economic Analysis |
| BGS | Below Ground Surface |
| BMP | Best Management Practices |
| BTGS | Big Timber Grade School |
| CEQ | Council of Environmental Quality |
| CFR | Code of Federal Regulations |
| CMC | Carboxymethyl cellulose |
| CNF | Custer National Forest |
| DEIS | Draft Environmental Impact Statement |
| DHES | Montana Department of Health and Environmental Services |
| DNRC | Department of Natural Resources and Conservation |
| DSL | Montana Department of State Lands |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| EMT | Emergency Medical Technician |
| EPA | Environmental Protection Agency |
| F.I.R.E | Financial Institutions Real Estate |
| FAP | Federal Aid Primary |
| FAS | Federal Aid Secondary |
| FEIS | Final Environmental Impact Statement |
| FONSI | Finding of No Significant Impact |
| FP | Forest Plan |
| FS205 | Forest Service 205 |
| FTE | Full-time Equivalent |
| FY | Fiscal year |
| GNF | Gallatin National Forest |
| IECO | International Engineering Company |
| IRA | Integrated Resource Analysis |
| IX | Ion Exchange |
| MA | Management Area |
| MCA | Montana Code Annotated |
| MDFWP | Montana Department of Fish, Wildlife, and Parks |
| MDLI | Montana Department of Labor and Industry |
| MEPA | Montana Environmental Policy Act |
| MFSA | Major Facilities Siting Act |
| MGWPCS | Montana Groundwater Pollution Control System |
| MPDES | Montana Pollutant Discharge Elimination System |
| MSHA | Mine Safety and Health Administration |
| NEPA | National Environmental Policy Act |
| NOAA | National Oceanic and Atmospheric Administration |
| NPS | National Park Service |

| | |
|---|---|
| ORV | Off-road Vehicle |
| OSHA | Occupational Safety and Health Administration |
| PGM | Platinum Group Metals |
| PIC | Planning Information Corporation |
| PILT | Payment in Lieu of Taxes |
| PLS | Pure Live Seed |
| PMF | Probable Maximum Flood |
| PSD | Prevention of Significant Deterioration |
| REA | Rural Electric Association |
| RM | Roaded-Modified |
| R/O | Reverse Osmosis |
| ROD | Record of Decision |
| ROS | Recreation Opportunity Spectrum |
| RV | Recreation Vehicle |
| RVD | Recreation Visitor Day |
| SAG | Semi-Autogenous Grinding |
| SG31 | Sweet Grass 31 |
| SGHS | Sweet Grass High School |
| SH298 | State Highway 298 |
| SHPO | State Historic Preservation Officer |
| SMC | Stillwater Mining Company |
| SPGMR | Stillwater PGM Resources |
| SPM | Semi-Primitive Motorized |
| SPNM | Semi-Primitive Non-Motorized |
| T&E | Threatened and Endangered Species |
| TBM | Tunnel Boring Machine |
| TDS | Total Dissolved Solids |
| TSP | Total Suspended Particulates |
| TSS | Total Suspended Solids |
| USFS | U.S. Department of Agriculture Forest Service |
| USFWS | U.S. Department of the Interior Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| VAC | Visual Absorption Capability |
| VQO | Visual Quality Objective |
| WQB | Water Quality Bureau |

| | |
|---|---|
| mg/l | milligrams per liter |
| mg/Kg | milligrams per kilogram |
| tpy | tons per year |
| lb/ton | pounds per ton |
| ppm | parts per million |
| gpm | gallons per minute |
| cm/sec | centimeters per second |
| cy | cubic yards |
| cfs | cubic feet per second |
| Kg/day | kilograms per day |
| ft/day | feet per day |
| $ft^2$/day | square feet per day |
| mph | miles per hour |
| $\mu g/m^3$ | micrograms per cubic meter |
| $\mu$g/Kg | micrograms per kilogram |
| dB | decibel |
| g | gravity |
| g/Kg | grams per kilogram |

**ADIT** - A nearly horizontal passage, driven from the surface, by which a mine may be entered, ventilated, and dewatered.

**ALLUVIAL** - Pertaining to material or processes associated with transportation or deposition by running water.

**AMBIENT** - Surrounding, existing.

**ANALYTE** - A compound determined by an analysis.

**AQUITARD** - A rock unit with relatively low permeability that retards the flow of water.

**BENTHIC** - Pertaining to the bottom of a body of water.

**BERM** - A horizontal bench left in an exposed slope to increase slope stability and provide a place for sloughing material to collect.

**BEST MANAGEMENT PRACTICES** - Practices determined by the State of Montana to be the most effective and practicable means of preventing or reducing the amount of water pollution generated by non-point sources, to meet water quality goals.

**BIOLOGICAL ASSESSMENT** - An evaluation conducted on federal projects requiring an environmental impact statement, in accordance with the Endangered Species Act. The purpose of the assessment is to determine whether the proposed action is likely to affect an endangered, threatened, or candidate species.

**BORE HOLE** - A drill hole from the surface to an orebody.

**BREAKOUT** - In underground mining a breakout occurs when an underground opening (typically a raise or adit) breaks through to the exposed surface.

**COMPETENT ROCK** - Rock capable of supporting itself over limited spans.

**CROWN PILLAR** - A horizontal support pillar of rock left intact between levels of a mine.

**CULTURAL RESOURCES** - Remains of human activity, occupation, or endeavor, as reflected in sites, buildings, artifacts, ruins, etc.

**CYCLONE CLASSIFIER** - A cone shaped device used to separate (classify) material based on size. May be either wet or dry.

**DEWATERING** - The act of removing water.

**DIATOM** - A single-celled algae found in marine environments, an important source of food for small marine animals.

**DRILL SEEDING** - A mechanical method for planting seed in soil.

**ENDANGERED SPECIES** - Any plant or animal species which is in danger of extinction throughout all or a significant portion of its range. (Endangered Species Act of 1973).

**FELLFIELD** - A tract of bare, elevated country which is in more or less uncultivated condition.

**FLOTATION** - A mineral recovery process where individual mineral grains are selectively "floated" and skimmed off the top of an agitated water/chemical bath.

**FLOTATION AGENT** - Any of a number of chemical agents used in the separation of ore minerals and gangue by the froth flotation process.

**FORAGE** - Vegetation used for food by wildlife, particularly big game wildlife and livestock.

**FORB** - Any herbaceous plant other than a grass, especially one growing in a field or meadow.

**GAINING STREAM** - A stream that gains water as flow proceeds downstream. Water is gained from groundwater inflow and/or tributary streams.

**GANGUE** - The nonmetalliferous or nonvaluable metalliferous minerals in the ore; veinstone or lode filling. The mineral associated with the ore in a vein.

**GEOMORPHOLOGY** - That branch of both physiography and geology which deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution of landforms.

**GLACIAL DEPOSIT** - Any rock material, such as boulders, till, gravel, sand, or clay, transported by a glacier and deposited by or from ice or by or in the water derived from the melting of the ice.

**GNEISS** - A coarse-grained rock in which bands rich in granular minerals alternate with bands in which schistose minerals predominate.

**GRANITE** - A plutonic rock consisting essentially of alkali feldspar and quartz.

**HYDRIC SOILS** - Soils which are wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants.

**HYDROPHYTIC** - Water-loving; ability to grow in water or saturated soils.

**INDICATOR SPECIES** - Species of fish, wildlife, or plants which reflect ecological changes caused by land management activities.

**JOINT** - Fracture in rock, generally more or less vertical or transverse.

**LARVAL INSTAR** - The immature, feeding stage of an insect's life.

**LIQUEFACTION** - When an earthquake occurs, energy released by rupturing in the earth's crust causes cyclic waves to travel through the rock and soil mass. Saturated soils can then experience enough pressure between the individual grains that the soil loses its cohesion (shear strength) and behaves as a liquid.

**LITHIC SCATTER**- A concentration of man-made stone flakes and tools.

**LOSING STREAM** - A stream that loses water as flow proceeds downstream. Typically, water loss is via infiltration into the ground, and evaporation.

**MACROINVERTEBRATE** - Animals without backbones that are visible without a microscope; insects.

**MAFIC** - Pertaining to or composed dominantly of the magnesian rock-forming silicates; said of some igneous rocks and their constituent minerals. Contrasted with felsic.

**MANAGEMENT AREA** - Geographic areas, not necessarily contiguous, which have common management direction, consistent with the Forest Plan allocations.

**MAXIMUM CREDIBLE EARTHQUAKE** - The largest rationally conceivable earthquake that could occur in a particular area.

**MAXIMUM PROBABLE FLOOD** - The flood event that could cause the highest expected river stage.

**METAMORPHOSE** - To change into a different physical form.

**MINERAL LODE CLAIM** - A claim for possession of land in the public domain (especially national forests) containing minerals under the Mining Law of 1872.

**MINERALIZATION** - The process by which a valuable mineral or minerals are introduced into a rock resulting in a potential or actual ore deposit.

**MITIGATION** - Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

**MORAINE** - Drift, deposited chiefly by direct glacial action, and having constructional topography independent of control by the surface on which the drift lies.

**NYMPHAL INSTAR** - The immature, non-reproductive stage of an insect's life.

**ORE BENEFICATION** - The process of enriching the concentration of ore minerals by mechanical separation of ore minerals from gangue. The resulting concentrate contains most of the ore minerals, and the waste is called tailing.

**ORE-GRADE** - When minerals are found in sufficient concentration to warrant extraction by mining, the mineralized area is considered an ore deposit. Ore is mineral that can be extracted from the ground at a profit. Grade is a term used to define the amount of concentration of a mineral in rock, and is usually expressed in units of metal per ton of rock, or in percentage.

**PACKER** - A compressible cylinder of rubber and metal that is placed in or outside a well to plug or seal the well at a specific point.

**PERIPHYTON** - Microscopic organisms attached to and growing on the bottom of a waterway or on submerged objects.

**PERMEABILITY** - The capacity for transmitting a fluid; depends on the size and shape of the pores, the size and shape of their interconnections, and the extent of the later. It is measured by the rate at which a fluid of standard viscosity can move a given distance through a given interval of time.

**PICTOGRAPH** - Any conventionalized representation of an object.

**PIEZOMETER** - A well, generally of small diameter, that is used to measure the elevation of the water table.

**PORTAL** - Surface entry into a mine, particularly to a drift, tunnel, or adit.

**RAISE** - A mine shaft driven from below upward.

**REAGENT** - A substance used in a chemical reaction to detect, measure, examine, or produce other substances.

**RIPARIAN** - Situated on or pertaining to the bank of a river, stream, or other body of water. Normally used to refer to the plants of all types that grow along or around springs.

**ROADLESS AREA** - That area which is absent of roads which have been improved and maintained by mechanical means to ensure relatively regular and continuous use, and is bounded by a road, the edge of a right-of-way, other land ownership, or a significant imprint of man.

**SCOPING** - A term used to identify the process for determining the scope of issues related to a proposed action and for identifying significant issues to be addressed.

**SEDIMENTARY** - Rock formed of sediment, especially: (1) Clastic rocks, as, conglomerate, sandstone, and shales, formed of fragments of other rock transported from their sources and deposited in water. (2) Rocks formed by precipitation from solution, as, rock salt and gypsum, or from secretions of organisms, as, most limestone.

**SENSITIVE SPECIES** - Those species identified by the U.S. Forest Service Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in (1) population numbers or densities, or (2) habitat capability that would reduce a species existing distribution.

**SHAFT** - A vertical excavation of limited area compared with its depth, located alongside or through an orebody for access.

**SHEAR ZONE** - A zone in which shearing has occurred on a large scale so that the rock is crushed and brecciated.

**STOPING** - The loosening and removal of ore in a mine either by working upward (overhead or overhand) or downward (underhand).

**STRIKE** - The course or bearing of the outcrop of an inclined bed or structure on a level surface; the direction or bearing of a horizontal line in the plane of an inclined stratum, joint, fault, cleavage plane, or other structural plane. It is perpendicular to the direction of the dip.

**SUBSIDENCE** - The sinking of a large part of the earth's crust.

**TAILING** - Second grade or waste material derived when raw material is screened or processed.

**TAILING POND** - A containment designed to receive and hold mill tailing, which is usually a fine ground material in a water slurry.

**TALUS** - A collection of fallen disintegrated material which has formed a slope at the foot of a steeper declivity.

**TECTONIC** - Of, pertaining to, or designating the rock structure and external forms resulting from the deformation of the earth's crust.

**THREATENED SPECIES** - Any species of plant or animal which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

**TOE** - Terminal edge or edges of a substance.

**TRANSMISSIVITY** - The rate at which water is transmitted through a unit width of aquifer under a hydraulic gradient.

**VISUAL ABSORPTION CAPABILITY (VAC)** - The relative ability of a landscape to accept management practices without affecting its visual characteristic. The capability to absorb visual change. A prediction of how difficult it will be for a landscape to meet recommended VQOs.

**VISUAL QUALITY OBJECTIVES (VQO)** - Descriptions of a different degree of alteration of the natural landscape based upon the importance of aesthetics.

**WETLAND** - Lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface.

This final Environmental Impact Statement (EIS), prepared by the Montana Department of State Lands (DSL) and Gallatin National Forest (GNF), describes an evaluation of a proposal by Stillwater PGM Resources (SPGMR) to develop a precious metals mine in the East Boulder River valley of south-central Montana. This is a summary of the final EIS containing a description of the mine plan, the affected environment, impacts of the mine upon the environment, and alternatives to the proposed plan. If more detail is desired regarding all or certain aspects of the proposed mine action, the final EIS should be reviewed in whole. The final EIS, if not attached, may be obtained by contacting one of the following persons:

- Ms. Jo Stephen - Hard Rock Bureau<br>Montana Department of State Lands<br>Capitol Station<br>1625 Eleventh Avenue<br>Helena, MT 59620
- Mr. Sherm Sollid - Gallatin National Forest<br>Federal Building<br>P.O. Box 130<br>Bozeman, MT 59771
- Mr. Steve Brady - Gallatin National Forest<br>Big Timber Ranger District<br>P.O. Box 196<br>Big Timber, MT 59011

The final EIS may also be reviewed at the following locations during normal business hours:

Montana Department of State Lands, 1625 Eleventh Avenue, Helena, MT

Montana Department of Health and Environmental Sciences, Water Quality Bureau, Cogswell Building, Helena, MT

Gallatin National Forest Office, Federal Building, Bozeman, MT

Big Timber District Ranger Office, Big Timber, MT

Northern Regional Office, U.S. Forest Service, Missoula, MT

Livingston Ranger District, Livingston, MT

Big Timber Public Library, Big Timber, MT

McLeod Post Office, McLeod, MT

Bozeman Public Library, Bozeman, MT

Livingston Public Library, Livingston, MT

Columbus Public Library, Columbus, MT

Custer National Forest Office, Billings, MT

Red Lodge District Office, Red Lodge, MT

## SUMMARY OF CHANGES BETWEEN DRAFT AND FINAL EIS

The draft EIS was released to the public in May 1991. The supplemental draft EIS, which addressed Alternative 8, was released to the public in August 1991. The public comment period for both documents ended on October 15, 1991. Forty-four comment letters were received on the draft and supplemental draft EIS's and two public meetings were held in Big Timber, Montana on June 5, 1991 and September 11, 1991 to accept public comments. Copies of the comments are included in Chapter Six of this final EIS as well as responses to each of the comments. In addition, the text of the draft EIS has been reprinted with changes in many places in response to the comments. Major changes are summarized in the following paragraph.

Many of the comments expressed concern over transportation and parking. In response, SPGMR has changed the proposed action to include a bussing program and reduced parking lot, and the impact analysis has been revised. Many comments were also received expressing concern over degradation of surface and groundwater. An independent analysis of the water treatment alternatives was conducted and further information was included, however, as explained in the final EIS, the decision on water treatment will be made by the Board of Health and Environmental Sciences. Additional data, recommended ambient levels for various compounds and elements, were included in both the surface water and groundwater discussions, and impacts were revised based on this additional data. The agencies endorse the recommendations presented in the Water Quality Bureau's analysis. Many comments were also received expressing concern over reclamation. Additional mitigation measures added to Alternative 7 would require revisions to the proposed reclamation plan. Additional mitigation and monitoring measures were added for many resources besides reclamation. Please refer to Alternative 7 for information on mitigation and monitoring measures. New information on the distribution of the sensitive plant species Claytonia lanceolata var. flava has been added along with a reevaluation of elk habitat effectiveness index.

Numerous other changes, corrections, and clarifications have been made to the text, including two new figures and several new tables. The Biological Assessment for this project, published in May 1991, did not require modifications according to the U.S. Fish and Wildlife Service and is included as Appendix D for easy reference. The agencies have identified their preferred alternatives in this final EIS.

## DESCRIPTION

The proposed East Boulder Mine Project consists of an underground platinum and palladium mine, a mill to process and concentrate ore, a surface mine and mill support complex, a tailing retention impoundment, and other secondary facilities required to support the operation. The mine site is located in Sweet Grass County, Montana, within the East Boulder River drainage at the end of Forest Service Road 205, approximately 11 miles south of McLeod (Figure 1.1-1). Big Timber, Montana is approximately 30 miles north of the mine site. The majority of the surface facilities would be located adjacent to the main access adit in the East Boulder River valley, but other surface construction would occur on patented or mineral lode claims at higher elevations. SPGMR is the company proposing the project.

## EIS AND PERMITTING PROCESS

Montana DSL and GNF have joint responsibility as "lead" agencies for this EIS. The EIS process was initiated in response to a request made by SPGMR for a mine operating permit submitted to the agencies in February 1990. After subsequent revisions, prepared in response to deficiencies in the original submittal, the permit application was deemed complete by the agencies on August 22, 1990. This action triggered a one-year time frame required by Montana statute for development and completion of the EIS.

## DEVELOPMENT OF ALTERNATIVES

The Montana Environmental Policy Act and the National Environmental Policy Act require that if an action taken by the State of Montana or the U.S. Forest Service "might significantly affect the quality of the human environment" an EIS must be prepared. Because DSL and GNF have determined that an EIS is required for the proposed mine, the agencies are required to consider the environmental effects of a proposed action and of reasonable alternatives to that action. Two alternatives which must be considered in the EIS are the "Proposed Action" Alternative, which is the East Boulder Mine Project as proposed by SPGMR, and the "No Action" Alternative, which is essentially an agency rejection of the proposed project plan and denial of the required operating permit.

To identify significant issues and concerns associated with the proposed action, the agencies held a public scoping meeting in Big Timber, Montana, on June 28, 1990. Comments, suggestions, and concerns about the project and associated EIS were gathered. Written comments about the proposed action were also received during the 45-day scoping period which followed the public meeting. Another public meeting was held in Big Timber on September 5 to present preliminary alternatives identified (as a result of the scoping process) to the public and to solicit additional comment. The agencies held other, less formal meetings with interested parties throughout the development of the final EIS.

Public comment suggested that much of the concern focused on transportation issues, socioeconomic impacts to the surrounding communities, wildlife disruptions, water quality impairment, and tailing dam stability, as well as other potential environmental impacts. The agencies evaluated public comment and concerns raised by specialists within DSL and GNF, and determined that the following alternatives would be evaluated in the EIS:

- Alternative 1 - No Action Alternative;
- Alternative 2 - SPGMR's proposed action;
- Alternative 3 - Modified tailing impoundment configuration; outside tailing dam slope would be 2(H):1(V) as opposed to the steeper face of 1.6(H):1(V) proposed by SPGMR;
- Alternative 4 - Alternative access road and power line alignment. Includes Alternatives 4A and 4B which change access to the mine from SG 31, the road currently in the East Boulder River valley, to an alternate alignment;
- Alternative 5 - Power supply corridor systems. Includes Alternatives 5A and 5B which route electrical power from an existing transmission line west of Big Timber to a power substation just north of the Yellowstone River;

- Alternative 6 - Water treatment options. A set of alternative water treatment methods is considered to prevent or reduce degradation of surface water and groundwater and the East Boulder River.

- Alternative 7 - Proposed action with modifications. This alternative includes the proposed action with a number of mitigation and monitoring measures designed to reduce or eliminate environmental impacts.

- Alternative 8 - Twin production adits, instead of one main production adit. This alternative was proposed by SPGMR after the release of the draft EIS. It was evaluated in a supplemental draft EIS released in August 1991.

All of the above alternatives were evaluated in detail in the draft EIS for potential environmental impacts. Other alternative roads and power line corridors were suggested but dismissed from further consideration, typically because of detrimental environmental impacts. In addition, another tailing impoundment configuration with a 3(H):1(V) outside dam slope was considered, but not evaluated in detail because of the drastic reduction on mine operating life.

ALTERNATIVES EVALUATED

Alternative 1 is the No Action alternative under which SPGMR would not develop the East Boulder Mine Project. The No Action alternative implies that the existing condition of the environment will remain undisturbed by activities associated with the mine project. However, the baseline environmental condition evaluated in the EIS does not reflect current environmental conditions. This is because SPGMR has valid permits, issued by the Big Timber Ranger District and DSL, for mining exploration activities in the East Boulder River drainage area (see Jackpine Project Exploration Adit Decision Notice and Finding of No Significant Impact, 1/12/88 Appendix B). Some of the activities allowed under the exploration permit will modify existing environmental conditions. Therefore, the baseline environmental conditions evaluated in this EIS assumes these modifications have taken place as provided for in the Jackpine Exploration Permit.

Development of the East Boulder Mine Project, as proposed by SPGMR and described in Alternative 2, would require the disturbance of three areas for project facilities (Figure 2.3-3). The mine, mill, tailing impoundment, percolation ponds, and mine portal would be located in the East Boulder River valley on SPGMR millsite claims. This area is known as the East Boulder permit area, and approximately 200 acres are anticipated to be disturbed for project implementation. A mine exit and ventilation shaft would be developed on approximately 3 acres near the confluence of the East Boulder River and Brownlee Creek. This area is known as the Brownlee Creek permit area. Other shafts, adits, and ventilation openings would be developed on approximately 30 acres in the Placer Basin permit area.

A tailing impoundment would be constructed to store fine grained mine waste which cannot be used as backfill or for other construction purposes. The impoundment would cover approximately 105 acres at project completion, and be designed to hold approximately 7.9 million cubic yards of material.

Other major facilities to be located at the East Boulder permit area include a parking lot for cars, busses, and mine vehicles; a mill for processing and concentrating ore; percolation ponds to be used for disposal of excess water from the mine and mill operations; and mine offices.

Access to the mine, as proposed, would be routed from FAS 298 at McLeod; south on Sweet Grass County road 31 (SG 31) along the East Boulder River valley to the GNF boundary; then south-east on FS 205 to the project boundary. SPGMR would upgrade roads and bridges as necessary to handle additional traffic and vehicular weight. Power for the project would initially be supplied by on-site generators, but SPGMR has proposed upgrading the electrical service in the East Boulder River valley to 69 kV and extending that line to a substation at the East Boulder permit area.

The project would operate for approximately 27 years; full mine production would be reached within about 5 years of project initiation. The workforce would range from about 85 persons during the first year of construction up to approximately 600 project workers during full mine operation. SPGMR plans two mining shifts per day, five days per week, while mill and maintenance functions would operate three shifts per day, seven days per week.

Alternative 3 is a modified tailing impoundment configuration. This alternative, developed in response to public and agency concerns over impoundment stability and reclaimability, modifies the outside dam slope from 1.6(H):1(V) to a less steep 2(H):1(V). This alternative would reduce the impoundment's capacity by approximately 9 percent and, therefore, reduce the effective operating life of the project by approximately 2.5 years.

Alternatives 4A and 4B would re-route mine traffic from the existing valley road, SG 31. The Bench Route, Alternative 4A, is located on private land approximately 60 to 80 feet above the west side of the East Boulder River. Alternative 4B, known as the Bench/Valley Route, consists of a combination of the existing route of SG 31 and the Bench Route. Transmission lines could also be routed along any of these alternatives.

Alternatives 5A and 5B were developed to provide electrical power to a power substation just north of the Yellowstone River. Each of the alternatives would connect to an existing 161-kV transmission line located 6-7 miles north of the Yellowstone River and travel south then southeast across private agricultural and ranch land to connect at the Duck Creek substation. From the Duck Creek tap power would be routed through existing lines to the East Boulder permit area.

During development of this EIS the agencies recognized that degradation of groundwater and surface water could occur in the vicinity of the mine due to the discharge of mine wastewater containing nitrates and metals. In addition, the proposed facility's sewage disposal system is likely to introduce nutrients, including nitrates, into the groundwater. Alternative 6 evaluates various methods of reducing water quality degradation.

The need to expand the permit boundary could be foreseen under some sewage and wastewater treatment options. A sensitivity analysis for expansion of the permit boundary of up to 20 acres, to contain possible sewage treatment facilities and mine waste water treatment facilities, has been prepared. This information is available for review in the project files. The analysis reveals that expansion of up to 20 acres at the East Boulder Mine main permit area, for the facilities described, would not adversely affect the environment, so long as the expansion did not occur in the floodplain, and the sewage treatment plant provided for adequate protection from groundwater contamination.

During project scoping and evaluation of Alternative 2, the agencies identified various measures and plan modifications which would prevent or reduce environmental impacts. These mitigating measures were combined with the SPGMR's proposal to create Alternative 7, Proposed Action with Modifications.

Alternative 8, Twin Production Adits, was proposed by SPGMR after release of the draft EIS. This alternative consists of replacing the single 16-foot diameter main East Boulder adit as described in the proposed action and the Jackpine EA with two parallel 13 1/2-foot diameter adits spaced approximately 25 to 50 feet apart. In addition, the Brownlee Creek adit and breakout would be eliminated.

## AFFECTED ENVIRONMENT

The proposed location of SPGMR's mine facilities is within the East Boulder River valley, approximately 30 miles south of Big Timber, Montana, in Sweet Grass County. The surrounding area is mountainous, relatively sparsely populated, and noted for its scenic beauty and recreational opportunities such as hunting, fishing, and hiking. Designated wilderness areas are nearby and Yellowstone National Park is approximately 30 air miles from the proposed Placer Basin permit area.

The three project permit areas range in elevation from approximately 6,200 feet above sea level to an elevation of approximately 9,250 feet above sea level. Brownlee Creek, Canyon Creek, and Dry Fork are tributaries of the East Boulder River in the study area, and the East Boulder River in turn feeds into the Main Boulder River near McLeod. Vegetation in proposed disturbance areas ranges from cottonwood riparian communities at lower elevations near drainages, to alpine plant associations at the Placer Basin permit area. Wildlife is abundant and varied, and the area is considered habitat for many big game species. In addition, animal and plant species of special concern, including some animal species with threatened or endangered status, are believed to be present or around in the study area used for this EIS.

The climate in the area of concern is generally dry and cool, with an annual precipitation of 20 to 25 inches, and an annual temperature of 38°F, although these conditions are variable depending on location and elevation. Air quality is good throughout the area.

## ENVIRONMENTAL CONSEQUENCES

The alternatives described previously were evaluated for their potential impacts on various environmental, social, and cultural resources (See Chapter Four). A summary of the results of this evaluation follows.

### Alternative 1

This alternative represents baseline conditions which assume full implementation of the approved Jackpine Exploration Project. Potential impacts to water resources include minor increases in sediment loading to the East Boulder River, possible groundwater degradation, alteration of groundwater flow patterns, and possible changes in groundwater availability in limited areas. Potential soil impacts include slight decreases in long-term soil productivity and soil erosion near stream crossings, particularly during construction of new bridges or shoring of existing structures. Impacts to wildlife include the loss of deer habitat due to increased road traffic, and a possible change in fishing demand on the East Boulder River. Impacts to vegetation include the removal of approximately 30 acres from the timber base, possible weed infestations in disturbed areas, and some habitat loss for a species of special concern, yellow springbeauty. Existing air quality will undergo some degradation due to increases in particulate and gaseous emissions. Full- and part-time East

Boulder River valley residents could experience an alteration in land use habits due to increased traffic. Impacts to visual resources will be short-term, localized mostly to the foreground distance zone; some contrasts associated with landscape modification will occur. Recreational impacts include a change from a semi-primitive setting to one less isolated, adverse effects on hunting in the East Boulder River valley, increased poaching, and increased use of Roadless Area 1-371 and the Absaroka-Beartooth Wilderness. Increased noise levels will result from mine tunneling and construction activities associated with exploration.

Alternative 2

This alternative consists of SPGMR's proposed project. Potential impacts resulting from the implementation of this project are summarized by resource.

Impacts to cultural resources would include possible physical and/or visual alteration of cultural resource properties, intentional collection and destruction of cultural material due to increased recreational activity, and unintentional disturbance of unstable land forms which contain buried cultural resources due to increased recreational activity.

Impacts to water resources would include temporary increases in runoff and erosion during construction resulting in a 5 to 7 percent increase in sediments carried by the East Boulder River (no adverse impacts to downstream beneficial uses or channel patterns are anticipated), possible surface and groundwater contamination from spills or leaks of chemicals and fuels, possible surface and groundwater contamination primarily from the mine discharge water with some contamination from the septic system, possible increased flows in the East Boulder River from percolation pond water infiltration migration (flow increases could range from 0.5 to 25 percent) possible clogging of the percolation ponds resulting in an overflow, possible flow reduction in the East Boulder River between the permitted surface water withdrawal point and the area of river water recharge from the percolation ponds, additional sediment loading to the East Boulder River during mine closure and reclamation, and possible groundwater contamination from a leaking or overflowing tailing impoundment.

During the agencies' review of SPGMR's Plan of Operations, the Water Quality Bureau determined that the mine development, as outlined in the Proposed Action, would likely result in degradation of State waters, both surface water and groundwater. Subsequent to this determination, SPGMR submitted a Petition for Modification of the Quality of Ambient Water (August, 1991), in the East Boulder River, to the Board of Health and Environmental Sciences (BHES). The Water Quality Bureau determined the petition complete and the BHES decided at its August 23, 1991, meeting to participate in this EIS. This EIS, therefore, includes an analysis of SPGMR's petition, as prepared by the Water Quality Bureau, including recommendations to the BHES.

Impacts to soils and geology would include a slight decrease in long-term soil productivity, causing slightly less productive vegetative growth, possible increase in wind and water erosion to stockpiled soil during the short periods of manipulation and revegetation, alteration of the project area topography including the plateau-like tailing impoundment with steep downstream slopes, slight surface subsidence and increased bedrock fracturing causing increased surface water capture and increased mine water drainage, and possible reduction of tailing impoundment stability due to surface water infiltration upgradient of the tailing impoundment.

Impacts to wildlife and aquatic resources would include the loss of approximately 233 acres of wildlife habitat; possible reduction in wildlife use of the project site and surrounding area due to increased noise and human activity; temporary displacement of elk from small portions of summer/fall use habitat areas on the East Boulder Plateau; loss of approximately 10 acres of mule deer wintering habitat; increased potential for vehicle collisions with deer and other species (including bald eagle) due to increased traffic; displacement of local deer away from traffic areas resulting in indirect loss of summer and winter habitat; minor loss of white-tailed deer year-round habitat in the areas of SG 31 upgrade; some displacement of moose during construction and development; minor alterations of deer habitat in the Placer Basin permit area; loss of black bear habitat; increased potential for human/black bear interactions; minor habitat losses for raptors, upland game, and mountain lion; localized sedimentation of brown and rainbow trout spawning areas near bridge upgrades; possible minor fish and/or other aquatic organisms losses due to operation of the surface water diversion particularly during low flow periods; possible increase in flow in the East Boulder River due to increased groundwater discharge benefiting aquatic resources especially during low flow periods; possible catastrophic failure of the tailing dam resulting in detrimental impacts to aquatic resources; and possible change in fishing pressure on the East Boulder River (may cause a strain to local fish populations).

Impacts to vegetation would include the loss of approximately 233 acres of vegetation, likely destruction of yellow springbeauty plants located in the East Boulder permit area, possible invasion of noxious weeds in disturbed areas, removal of approximately 200 acres from timber production, and possible difficulties revegetating the tailing dam due to the steep slope.

Impacts to air would include degraded air quality due to increases in particulate and gaseous emissions. Impacts to roads and transportation would include reduced road safety and efficiency, increased number of traffic accidents, and increased dust and noise levels to East Boulder River valley residents. Land use impacts would include altered land use patterns in both urban and rural areas due to increased traffic, noise, and residential and commercial developments; and a change in timber production management plans in the permitted area.

Impacts to visual resources would occur in a localized area due to vegetation removal and facilities construction (particularly the tailing impoundment). The partial retention visual quality objective in the Forest Plan would not be met. Moderate and short-term visual impacts would occur due to reconstruction activities along the Main and East Boulder Rivers, and by activities associated with powerline upgrading along FAS 298 and SG 31.

Impacts to recreation and wilderness would include a change from a semi-private setting to one less isolated during the life of the mine. Noise generated from construction activities could reduce the opportunities for solitude in the Absaroka-Beartooth Wilderness. In addition, the scenic driving experience would be reduced, area campgrounds would be at capacity more often, recreational facilities in Big Timber and other communities would receive heavier use, and hunting and fishing pressure would likely increase.

Socioeconomic impacts would include a population migration into Sweet Grass County, peaking by Year 6 of the project, and creating demand for additional community services. Local governments would incur higher costs to provide a higher level of service. Changing socioeconomic conditions may create some dissatisfaction among residents of the area impacted by the project. Beneficial impacts would include additional annual direct and indirect income during operations, and additional monies for area education programs.

Noise impacts would be expected from mining and milling activities, mine and mill support vehicles, and commuter and access road traffic.

Alternative 3

Under this alternative the impoundment slope would change from a slope of 1.6(H):1(V) to a less steep slope of 2(H):1(V). Impacts from this alternative are likely to be as described for Alternative 2, except for new, reduced, or increased impacts associated with the changed tailing impoundment configuration. These impacts would include a reduced potential for slumping, slightly reduced potential for catastrophic failure, a reduction in the visual contrast (although visual impact would remain high), potential for easier reclamation of the impoundment slope (possibly reducing long-term visual impacts), and a reduction in the amount of tailing storage (this could result in a reduction in the amount of processed ore, thus moving project closure and corresponding socioeconomic impacts forward in time).

Alternative 4

This alternative considers two alternative road/power line alignments to the proposed upgrade of the existing county road. Impacts from this alternative would likely be the same as those described for Alternative 2 with the following exceptions. (1) Some increased soil erosion and subsequent long-term sedimentation to the East Boulder River would likely occur since the routes cross irrigated farm land. Short-term soil erosion resulting from construction activities would increase due to more stream crossings (relative to SPGMR's proposed route), thus increasing impacts to aquatic resources. (2) The alternative routes would have higher slumping potential. (3) The alternative routes would disturb cropland, rangeland, pasture, meadow, and wetlands. (4) Potential for weed invasion would increase. (5) Temporary air quality degradation and increased noise would result from construction activities. (6) Land use patterns in agricultural areas would be altered and could include irrigation interferences or loss of productive acreage. (7) Visual contrast and visual attention would be high during construction, but lessened somewhat during operation. (8) Impacts to East Boulder River valley residents would be greatly reduced.

Alternative 5

This alternative considers two alternative electrical power corridor systems to bring power from the existing Montana Power 161-kV line to the Duck Creek substation. Impacts would include increased soil erosion and soil compaction from power line construction, disturbances to terrestrial wildlife during construction, minor losses of habitat in grasslands and hay meadows including the permanent loss of about one-quarter acre due to construction and operation of the substation, increased potential for weed invasion in the disturbed areas, temporary disturbance to rangeland and productive agricultural lands during construction, temporary air quality degradation from land clearing and construction vehicles and equipment through particulate and gaseous emissions, possible interference with irrigation procedures on agricultural lands during construction and operation, visual attention drawn away from the Yellowstone River valley, noise disturbances up to 1.8 miles away from construction activity, and minor local noise disturbances (a soft hissing and cracking) during wet weather.

Other impacts could potentially occur to cultural, surface water, and aquatic resources however, these impacts cannot be site-specifically predicted at this time, as the power company has not yet acquired easements on the private lands that comprise this segment. Cultural and other environmental impacts, on the exact route chosen with the preferred corridor for segment 3, will be analyzed by the power company

prior to construction activities. The Montana State Historic Preservation Office (SHPO) will be consulted prior to corridor construction, as to the potential for impacts to cultural resources. The power company would be required to comply with mitigations or survey requests from SHPO, in regard to mitigation of impacts to cultural resources. The power company would also have to develop the other relevant baseline environmental information and analyze impacts prior to the development of the power corridor.

Alternative 6

This alternative considers three mine wastewater treatment processes for the prevention or reduction of surface water and groundwater quality degradation from implementation of the proposed action (Alternative 2). The disposal of mine wastewater containing contaminant substances including nitrates, metals, and dissolved solids in percolation ponds would likely result in the introduction of contaminants into the groundwater and the East Boulder River. The three alternative treatment processes are: (1) construction and operation of a water treatment plant to reduce concentrations of nitrates and other compounds/solids in the discharge stream to levels slightly above those currently found in the East Boulder River and area groundwater: (2) construction and operation of a water treatment system designed to remove a percentage of the nitrates and suspended solids from mine wastewater; and (3) minor modification of SPGMR's proposed mine water treatment system such that no contaminant compounds/solids would be present in discharge at concentrations greater than water quality criteria or drinking water standards. At a minimum, modification of the proposed treatment system would be required to assure water quality standards are not violated.

Impacts from the construction and operation of a treatment facility would include the prevention or reduction of contaminant levels in the groundwater and in the East Boulder River from mine-related operations under the proposed action; the potential production of solid wastes requiring disposal; the need for additional electrical power above that required for the proposed action; the maintenance of existing aquatic habitat in the East Boulder River or improved habitat conditions under the proposed action; and additional traffic, visual, and noise impacts at the mine site and along the access road for the life of wastewater treatment activities.

Alternative 7

This alternative considers the proposed action (Alternative 2) modified by the incorporation of several mitigation measures and monitoring requirements designed to reduce or eliminate residual impacts remaining after the application of the proposed mitigation program. Some impacts which would still likely occur under this alternative include a possibility of tailing dam failure due to a larger-than-anticipated earthquake; loss of vegetation habitat including habitat for yellow springbeauty; slight decrease in soil productivity causing slightly less productive vegetative growth; loss of wildlife habitat; disturbance to wildlife from increased noise and human activity; short-term air quality degradation due to construction of facilities, roads, and powerlines; increased noise, dust, and safety hazards associated with increased road traffic; and altered land use patterns affecting timber production, residential and commercial developments, and agriculture. The mitigation and monitoring measures are identified in the description of Alternative 7, Section 2.5.

Alternative 8

This alternative is similar to the proposed action (Alternative 2) except that the 16-foot-diameter main East Boulder adit would be replaced by twin 13 1/2-foot-diameter parallel adits, located approximately 25 to 50 feet apart. Also, the Brownlee Creek adit and breakout would be eliminated. Impacts to cultural resources, surface water, soils, vegetation and wildlife habitat, aquatic resources, visual, air quality, noise, and recreation which would occur or potentially occur due to the Brownlee Creek adit would be eliminated. In addition, the overall impacts to groundwater would be reduced since a reduction in mine water flow would occur with the elimination of the Brownlee Creek adit. The potential for mine-related subsidence due to the Brownlee Creek adit would be eliminated. A relatively small increase in waste rock production would occur. Other impacts would be the same as those listed for Alternative 7, since Alternative 8 incorporates the mitigation and monitoring measures listed in Alternative 7 (mitigation and monitoring measures are identified in Section 2.5).

**Agencies' Preferred Alternatives**

The agencies' preferred alternative for the proposed East Boulder Mine is Alternative 8, Twin Production Adits. The road route preferred by the agencies is Alternative 2, which is the existing route (RI) (SG31 and FS205). The existing route is preferred because the agencies do not have the authority to enforce use of a particular public road. Therefore, development of a new road would potentially increase the environmental impacts and provide no guarantee that SPGMR would not use the existing route. The preferred powerline alternative for the delivery of power to the Duck Creek tap is Alternative 5A (Power Corridor 1).

The agencies' analysis of treatment options presented in Chapter 4 indicates that, even with advanced treatment, some degradation of ground and surface water will occur. The agencies' preferred water treatment alternative is based on provisions of the Water Quality Act (WQA), including protection of uses (75-5-101, MCA) and Nondegradation Policy (75-5-303, MCA). The WQA allows the Board of Health and Environmental Sciences (BHES) to authorize degradation only after treatment of wastes; a demonstration of economic or social need; and a demonstration that any change in quality will not preclude present and anticipated beneficial uses.

It is the judgement of the agencies, based on current information, that the inorganic nitrogen concentration should not exceed 1.0 mg/l in the East Boulder River. This concentration is based on ARM 16.20.633(1)(e), which prohibits discharges which produce undesirable aquatic life. Thus, beneficial uses of surface water would not be impaired.

Efficient use of conventional treatment technologies would effectively remove particulate solids and associated metals, with the exception of manganese, and maintain existing water quality in the East Boulder River. However, granting the requested increase in the petition would not impair beneficial uses.

The agencies believe that beneficial uses of groundwater would not be impaired if the Board were to grant SPGMR's petition for 8 mg/l. The current available data indicates that concentrations above 2.7 mg/l in groundwater may result in surface water concentrations above 1 mg/l nitrogen, based on the assumption that all nitrogen enters surface water below the mine site. SPGMR would be required to submit final plans and specifications of all water treatment facilities to the agencies, demonstrating how the concentrations authorized by the Board would be achieved in both surface and groundwater.

The agencies' preferred alternative is a level of treatment equivalent to Alternatives 6a or 6b (Table S-1). This level of treatment will ensure that all present and anticipated uses of surface and groundwater are protected.

The Record of Decision (ROD) will be prepared by the agencies, following the Board's hearing in which the petition is acted upon. The findings of the Board will be considered in developing the ROD.

TABLE S-1

COMPARISON OF WATER TREATMENT ALTERNATIVE ACHIEVING ALLOWABLE CONCENTRATIONS

| Parameter | Existing Water Quality | SPGMR Requested Concentration | Applicable Standard | Maximum Allowable Concentration[1] | Alternatives Achieving Allowable Concentration[4] |
|---|---|---|---|---|---|
| Surface Water | | | | | |
| TDS | 100 | 200 | 250 | 200 | 2, 6a, 6b, 6c |
| Nitrate + Nitrite[2] | 0.09 | 5 | Inorganic Nitrogen 1.0 mg/l | Inorganic Nitrogen 1.0 mg/l | 6a, 6b |
| Ammonia[2] | <.11 | 0.4 | | | 6a, 6b |
| Chromium[3] | <.005 | 0.005 | 0.011 | 0.005 | 2, 6a, 6b, 6c |
| Iron[3] | 0.052 | 0.2 | 0.3 | 0.2 | 2, 6a, 6b, 6c |
| Manganese | <.012 | 0.03 | 0.05 | 0.03 | 6a, 6b, 6c |
| Lead[3,6] | <.021 | 0.003 | 0.0024 | 0.003 | 2, 6a, 6b, 6c |
| Groundwater[5] | | | | | |
| Nitrate | 0.1 | 8 | 10 | 8 | 2, 6a, 6b, 6c |
| Chromium[3] | <.02 | 0.02 | 0.05 | 0.02 | 2, 6a, 6b, 6c |

1. Maximum allowable concentration (mg/l), based on protection of beneficial uses or SPGMR requested concentration, whichever is more restrictive.
2. Inorganic nitrogen in the East Boulder River not to exceed 1.0 mg/l and ammonia not to exceed 0.4 mg/l, based on protection of aquatic life.
3. The agencies' analysis of baseline information indicates that conventional treatment of effluent will reduce the concentration of iron, chromium, and lead to below existing water quality.
4. Alternatives 3, 4, 5, 7, and 8 would be selected in combination with BHES determination of ambient levels. Alternative 1, No Action, would maintain existing water quality.
5. TDS, ammonia, iron, and manganese are not subject to the nondegradation requirement in groundwater. Because lead concentrations are below ambient levels, SPGMR has not petitioned for a modification.
6. Lead concentrations are a function of hardness. Criteria are based on average total hardness of 80 mg/l. SPGMR request is based on total hardness of 100 mg/l. Ambient hardness varies between 20-110 mg/l (see Chapter 3).

This final Environmental Impact Statement (FEIS) discloses the possible environmental consequences of the proposed Stillwater PGM Resources (SPGMR) platinum/palladium mine and mill in south-central Montana. The proposed action and alternatives have been carefully weighed and evaluated by agency officials and technical specialists. Environmental issues and concerns expressed by the public during public scoping and in response to the draft Environmental Impact Statement (EIS) have been incorporated into the analysis.

In this FEIS, all sections of the draft EIS have been reprinted, with changes made where necessary in response to public comments. The major changes include the addition of a bussing program to the proposed action, additional mitigation measures, goals and standards required for monitoring various resources, additional information on water treatment systems, inclusion of Alternative 8 with impacts assessment by resources (originally assessed in the supplemental draft EIS), inclusion of new data on water quality and East Boulder River flows, a reassessment of surface and groundwater impacts, and a reassessment of transportation impacts. Other minor changes to the text have also been made.

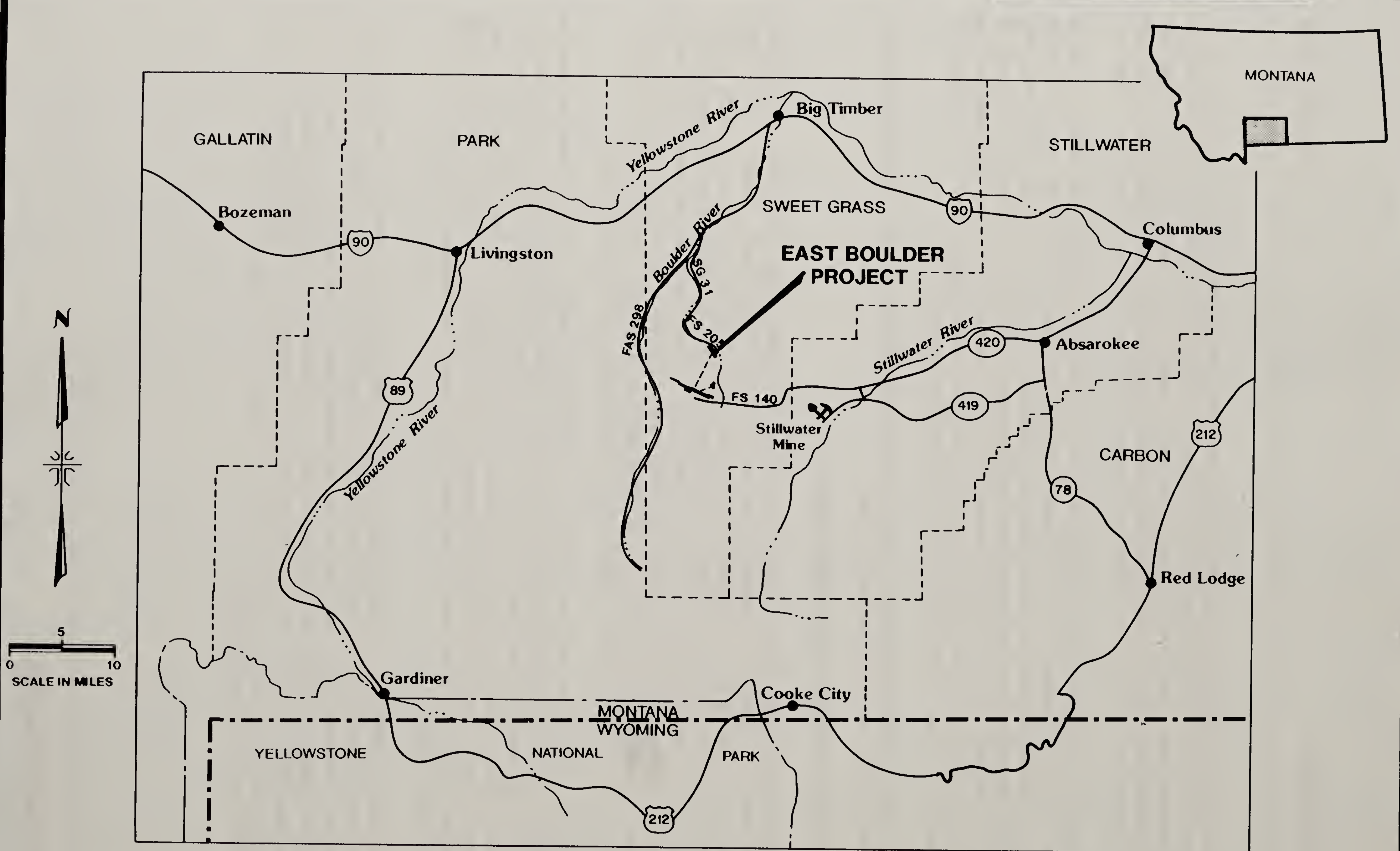
Additionally, this final EIS includes the agencies preferred alternatives, the public comments on the draft EIS, and agencies responses to public comments.

## 1.1 PROJECT LOCATION AND BACKGROUND

SPGMR (a partnership between Chevron U.S.A, Inc. and Manville Sales Corporation) has proposed development of an underground platinum/palladium mine in Sweet Grass County, Montana. The proposed mine site is located in the East Boulder River drainage, which lies within the boundaries of the Gallatin National Forest (GNF) at the end of Forest Service Road 205 (FS 205). This location is approximately 11 miles south of the community of McLeod, Montana, and 30 miles south of the town of Big Timber, Montana. The main adit would be located in Township 4 South, Range 13 East, Section 11; the Brownlee Creek adit would be located in Section 26; and the Placer Basin permit area would include parts of Sections 19, 20, 27, 28, 29, 33, 34, and 35. Figure 1.1-1 shows the location of the proposed project.

Exploration for platinum group metals (PGM) in the Stillwater Complex, a geologic formation consisting of layers of iron- and magnesium-rich igneous intrusions, began in the late 1960s. In 1973, ore-grade platinum and palladium mineralization was discovered in a zone approximately 27 miles in length. In 1979, the SPGMR partnership was formed and exploration activities began in the East Boulder River area. These efforts were put on hold in 1983 and later resumed in 1987. SPGMR, along with the Stillwater Mining Company (SMC), has staked mineral lode claims, both patented and unpatented, along the entire strike length of the deposit.

On January 12, 1988, GNF Big Timber Ranger District and the Montana Department of State Lands (DSL) issued exploration permits for a low-level exploration adit to access the ore body and to determine its mining potential. Preliminary work has begun on the exploration project including clearing of timber near the exploration adit for facilities and road development. In February 1990, SPGMR submitted a Plan of Operations to GNF and DSL as part of an application for a mining permit. The application was deemed complete by GNF and DSL on August 22, 1990. A decision on this permit application will be made after the EIS process has been completed.




**VICINITY MAP**

**FIGURE 1.1-1**

## 1.2 PURPOSE AND NEED FOR ACTION

The proposed East Boulder Mine Project would be the second platinum/palladium operation to be brought into production on the Stillwater Complex. In 1986, the SMC's Stillwater Mine near Nye, Montana, commenced production. The Stillwater Complex represents the only known commercially economical source of platinum and palladium in the western hemisphere. The worldwide demand for platinum and palladium has historically been supplied primarily by South Africa and the Soviet Union, where the only other known commercially recoverable deposits of the minerals are located. The purpose of this action would be to mine the valuable platinum and palladium deposits described above. This action would help meet the need for platinum and palladium in the marketplace, and would reduce the United States' dependency on foreign supplies of these metals.

Platinum is used primarily as a catalyst in pollution devices and in jewelry. In 1989, worldwide demand was approximately 3.4 million troy ounces. Palladium is used in space age electronics microcircuitry, as a catalyst in the chemical industry, and in dental alloys. In 1989, worldwide demand was approximately 3.3 million troy ounces. The U.S. demand for both metals is about one-half of the total demand.

The goals of the GNF are to ensure adherence to National Environmental Policy Act (NEPA) regulations, to minimize adverse environmental impacts on national forest surface resources, and to comply with all applicable federal and state air and water quality standards, and standards for the disposal and treatment of solid wastes. Furthermore, GNF would take all practical measures to harmonize operations with scenic values and maintain and protect fisheries and wildlife habitat that may be affected by the operation. The goals of the DSL are to ensure adherence to Montana Environmental Policy Act (MEPA) regulations, successfully implement short-term (interim) and long-term (final) reclamation of disturbed areas, and comply with other applicable federal and state laws and regulations.

This EIS presents the agencies' analysis of environmental impacts under NEPA and MEPA regulations and guidelines. The DSL and GNF will use the analysis to make final permitting decisions concerning the Operating Permit and Plan of Operations (United States Forest Service [USFS]) application, currently under review by the agencies. The agency responsibilities are described more fully in the sections that follow.

## 1.3 THE EIS PROCESS

NEPA and MEPA require that if any action taken by the State of Montana or the USFS might "significantly affect the quality of the human environment," an EIS must be prepared. It has been determined by GNF and DSL that an EIS is required before to making a decision regarding the proposed action. The EIS process involves several steps that are summarized as follows:

- The public is afforded the opportunity to identify issues and concerns, which are then addressed in the EIS, by participating in a public scoping meeting and by submitting written comments.
- The proposed action and reasonable alternatives are summarized in the draft EIS.
- Environmental resources that may be affected by the proposed action or alternatives are described in the draft EIS.

- Analysis of the impacts of the proposed action and alternatives is conducted and the results are presented in the draft EIS.

- A public review and comment period, including a public meeting, occurs after publication of the draft EIS. Substantive comments are incorporated into the final EIS.

- A final EIS is published and is used by the agencies in making a decision on the proposed action or alternatives.

- A Record of Decision is prepared by the agencies stating what decision was made, how the decision was made, and required mitigation and monitoring measures.

## 1.4 AGENCY RESPONSIBILITIES AND REGULATORY AUTHORITY

GNF and DSL are the joint lead agencies responsible for the preparation of this EIS. Interdisciplinary participation also included a third party contractor (Woodward-Clyde Consultants) selected by, and working under the direction of DSL, and in cooperation with GNF.

These agencies will consider the proposed action and alternatives presented in this EIS and issue a decision on the permits and approvals required for the East Boulder Mine Project. The agencies may approve the application as submitted, or they may deny approval of the application. Other options include approval of a modified application or approval with stipulations, which may require SPGMR to adopt measures to mitigate environmental impacts. The final decisions will be presented in a document or documents known as the Record(s) of Decision.

Since the proposed development would occur on both patented and unpatented mining lode claims, both GNF and DSL have the authority to regulate mining activity to some extent. GNF has authority over unpatented claims, and DSL has authority over both patented and unpatented claims. Several other federal, state, and local agencies may require permits, approvals, or licenses for the proposed project, as described below. A list of required permits is found in Table 1.4-1.

<u>Gallatin National Forest</u>

The East Boulder Mine Project ore body is located on national forest lands. SPGMR has claimed this ore under rights granted by the 1872 General Mining Law, as amended, which allows any prospector who discovers a valuable mineral deposit on national forest lands open to mineral entry to locate and work on a mining claim. The Organic Administration Act of 1897 authorizes the Secretary of Agriculture to regulate occupancy and use of the national forests for the protection and management of national forest resources. Regulations for mining activities on national forest lands are found in 36 CFR 228, which requires a Plan of Operations be submitted for review by GNF. GNF can place reasonable controls on the operations to protect surface resources, but they cannot deny approval of reasonable and logical mineral operations that comply with the law.

TABLE 1.4-1

PERMITS, LICENSES, AND APPROVALS POTENTIALLY REQUIRED FOR THE EAST BOULDER MINE PROJECT

| Permit, License, or Approval | Purpose |
|---|---|
| **Forest Service** | |
| Approval of Plan of Operation (36 CFR 228 Subpart A) | To allow for mineral exploration and development on national forest system lands. Approval incorporates management requirements to minimize or eliminate effects on other forest resources. Approval is documented in a Record of Decision. |
| Timber Sale Contract | To allow SPGMR to harvest commercial timber from the project area within national forest lands. |
| Cultural Resource Clearance | To obtain joint approval by the USFS and State Historic Preservation Office prior to construction activities. |
| Final Design Approval of Facilities | To ensure consistency of design of plant/portal site, conveyor system, waste rock disposal site, access roads, utility corridors, waste water treatment facilities, and tailing disposal impoundment with preliminary plans. Coordinate with DSL and other appropriate agencies. |
| **U.S. Fish and Wildlife Service** | |
| Biological Assessment Determination | To comply with the Endangered Species Act. If it is determined adverse effects would occur to threatened or endangered species as a result of the project, the agencies would consult with the U.S. Fish and Wildlife Service (USFWS) to design measures to protect the affected species. |
| **Department of State Lands** | |
| State Operating Permit (Metal Mine Reclamation Act) | To allow bonded mining development activity. |
| State Historic Presentation Office Review for culture compliance | To comply with cultural resource regulations. If historical, archaeological, or other cultural resources are located in the project area, the State Historic Preservation Officer (SHPO) will advise GNF and DSL on impact mitigation of sites eligible for nomination to the National Register of Historic Places. |
| **Army Corps of Engineers** | |
| 404 Permit (Clean Water Act) | To control discharge of dredged or fill material into waters of the United States or on wetlands. |

TABLE 1.4-1
(Concluded)

| Permit, License, or Approval | Purpose |
|---|---|
| **Department of Health and Environmental Sciences** | |
| Approval of Plans and Specifications for a Wastewater Disposal System | To ensure any public wastewater disposal system (serves 25 or more people daily) conforms to DHES standards set forth in Circular No. 84-10. |
| **Department and Board of Health and Environmental Sciences Air Quality Bureau** | |
| Air Quality Permit to Operate an Underground Mine (Montana Clean Air Act) | To control emissions of more than 25 tons per year of particulate matter. |
| Air Quality Permit to Construct and Operate an Underground Exploration Project | To control particulate emissions and emissions from on-site power generators. |
| **Department and Board of Health and Environmental Sciences Water Quality Bureau** | |
| Change in Quality of Ambient Waters (Water Quality Act) | To control discharge to groundwater and surface water in accordance with nondegradation requirements. |
| Montana Pollutant Discharge Elimination System Permit (MPDES) | To control discharge to surface waters by setting water quality limitations and requiring self-monitoring. |
| Montana Groundwater Pollution Control System Permit (MGWPCS) | To control the discharge of pollutants into state groundwaters by setting effluent limitations and requiring self-monitoring. |
| **Department and Board of Natural Resources and Conservation** | |
| Water Rights Permit (Montana Water Use Act) | To allow beneficial use of state waters obtained through any surface water diversion or through groundwater withdrawal exceeding 35 gallons per minute. |
| **Sweet Grass Conservation District** | |
| 310 Permit (Natural Streambed and Land Preservation Act) | To allow any activity within the mean high water line of a perennial stream. Montana Department of Fish, Wildlife, and Parks (MDFWP) provides recommendations and consultation. |
| **Hard Rock Impact Board/Affected local government units** | |
| Fiscal Impact Plan (Hard Rock Mining Impact Act) | To mitigate fiscal impacts on local government services. |
| **Sweet Grass County** | |
| Floodplain Development Permit | To allow construction of facilities within designated 100-year floodplains. |

Montana Department of State Lands

The 1971 Metal Mine Reclamation Act, also known as the Hard Rock Mining Act, is designed to prevent land and surface water degradation by requiring lands disturbed by mining to be stabilized and reclaimed. This act applies to all lands within the State of Montana, whether federal, state, or private ownership. Under this act, the DSL has the authority to issue an operating permit for the proposed mine and mill to inspect facilities and operations for compliance with the permit and applicable laws, to check the company's self-monitoring through random, split, and spot sampling, and for overseeing reclamation activities. Before the DSL can issue an operating permit, a reclamation bond must be posted with the agency, and must be of sufficient amount for the state to complete reclamation in the case of default by the operator.

Costs to the State of Montana for reclamation of lands disturbed under a mine operating permit are based on requirements for water treatment, demolition and removal of surface facilities, earth moving, soil replacement, seedbed preparation including amendments, and revegetation. An itemized list of costs for applicable tasks is prepared using information derived from the approved operating and reclamation plan. The bond requirement is likely to be about $3.5 million.

Some reclamation costs are not appropriately covered by performance bond. Perpetual treatment or maintenance costs are examples. In these cases, the State requires the mining company to establish a trust fund in perpetuity, which is of sufficient size that annual interest income meets anticipated annual expenditures. This trust is in addition to normal reclamation bonding.

Bond amounts are subject to periodic review and redetermination. In addition, the USFS can require a reclamation bond if it deems the State's inadequate.

Based on experience at projects with similar reclamation requirements, a preliminary range of bond amounts is from $8,000 to $12,000 per acre, or $2,000,000 to $3,500,000 for the East Boulder Mine Project considering potential boundary expansions and mitigations.

Montana Department of Health and Environmental Sciences

Air Quality Bureau

The Air Quality Bureau of the Montana Department of Health and Environmental Sciences (DHES) administers the Montana Clean Air Act. Any proposed project with estimated pollutant emissions (without emissions controls) exceeding 25 tons per year must obtain an air quality permit before commencement of construction. The applicant must apply Best Available Control Technology (BACT) to each emission source, and demonstrate that the project will not violate Montana or Federal Ambient Air Quality Standards.

Water Quality Bureau

The Water Quality Bureau of the DHES administers the Montana Water Quality Act. This law provides a framework for the classification and protection of surface and groundwater uses. It also establishes surface water quality standards as well as permit programs to control the discharge of pollutants into state waters. The company must construct and operate the proposed tailing impoundment, sewage treatment plant, and other facilities to prevent water discharge, seepage, drainage, infiltration, or flow that may pollute surface or groundwaters. Plans and specifications must be submitted to DHES for approval.

A Montana Pollutant Discharge Elimination System (MPDES) permit must be obtained before any discharge to surface water can occur. This permit contains water quality limitations and requires self-monitoring by the permittee, with verification by the Water Quality Bureau. A Montana Groundwater Pollution Control System (GWPCS) permit is not required for the proposed operation since groundwater protection and monitoring are incorporated into the mine operating permit issued by DSL (ARM 16.20.1012[1][M]). However, the limits applied to SPGMR for discharge of groundwater pollutants would be those set by the Board of Health and Environmental Science (Board). Discharges to surface waters and groundwater for this project will contain some compounds in concentrations greater than existing water quality. Therefore, discharges to surface waters and groundwater would require a modification of the allowable ambient conditions. SPGMR has submitted a petition to the Board to modify the ambient water conditions in the East Boulder River.

Board of Health and Environmental Sciences

The Board of Health and Environmental Sciences (BHES) is the policy-making body which oversees and approves actions of the Department through the petitioning process in Montana's nondegradation rules (ARM 16.20.701 et seq.). The BHES may allow degradation of state water, based on necessary economic or social factors; but in no case may degradation be allowed that will preclude any present or future beneficial uses. Following BHES action, a statement of reasons for granting or denying the petition is issued.

During the agencies' analysis of SPGMR's Application for a Plan of Operations, the WQB determined that the project would constitute a new source of pollution and, therefore, would be subject to Montana's nondegradation rules (ARM 16.20.701 et seq.). Subsequently, SPGMR submitted a Petition for Modification of Quality of Ambient Water (SPGMR 1991a) on April 15, 1991. This EIS includes an analysis of the petition.

BHES will hold a formal public hearing on the petition. A decision to grant or deny the petition can either be made at that time, or not later than the BHES's next regularly scheduled meeting. All persons who are on the USFS-DSL EIS mailing list will receive notice of BHES's hearing.

Montana Department of Natural Resources and Conservation

The Department of Natural Resources and Conservation administers two acts that are applicable to mining development in Montana: The Montana Major Facility Siting Act (MFSA) and the Montana Water Use Act. The MFSA requires state approval before construction of any electrical transmission line that exceeds 69 kV or 10 miles in length. A water rights permit is required by the Montana Water Use Act for any surface water diversion or a groundwater withdrawal exceeding 100 gallons per minute.

Montana State Historic Preservation Office

Under the Montana Antiquities Act and the National Historic Preservation Act, the State Historic Preservation Officer (SHPO) has the responsibility to cooperate with and to advise GNF and DSL when potentially valuable historical, archaeological, or other cultural resources are located in the project area. Part of the advice given may include comments on a company's plan for impact mitigation of sites eligible for nomination to the National Register of Historic Places. The office also reviews the EIS to ensure compliance with the cultural resource regulations.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) administers the Endangered Species Act and the Bald Eagle Protection Act. To comply with the Endangered Species Act, GNF must prepare a Biological Assessment to determine impacts, if any, that would adversely affect threatened and endangered species. If it is determined adverse effects may occur, GNF will consult with the USFWS to design measures to protect the affected species.

Hard Rock Mining Impact Board

The Hard Rock Mining Impact Act was enacted in 1981 to assist local governments in handling financial impacts caused by large-scale mineral development projects. The legislature recognized that: (1) new mineral development projects may result in the need for local governments to provide additional services and facilities causing a fiscal burden for local taxpayers, before mine-related revenues become available; and (2) some local government units may lack jurisdiction to tax a new development. Therefore, the Hard Rock Mining Impact Board (part of the Montana Department of Commerce) oversees an established process for identifying and mitigating fiscal impacts to local governments, and acts as a "referee" in disputes between local governments and project developers. The operating permit issued by the DSL is not valid until an impact mitigation plan has been approved by the Hard Rock Mining Impact Board. The impact mitigation plan submitted by the developer identifies the increased public sector costs associated with major mineral development, and commits to pay, according to a specified time schedule, all increased capital and net operating costs that result from the development to local government units.

Army Corps of Engineers

The Corps of Engineers would require a 404 permit (Section 404 of the Clean Water Act) for any construction or "dredge and fill" activities affecting navigable waters or wetlands.

Sweet Grass County

Sweet Grass County has the option to review and issue a floodplain development permit pursuant to 76-1-113, MCA for any activity that infringes on the 100-year floodplain.

Sweet Grass Conservation District

Any mining disturbance occurring within the normal high water level of streams inside or outside of GNF boundaries would require the approval of the Sweet Grass Conservation District. This approval would constitute a "310 permit" under the Natural Streambed and Land Preservation Act. Prior to granting approval, the district would consult with GNF and the Montana Department of Fish, Wildlife and Parks (MDFWP).

### 1.5 ISSUES AND CONCERNS

To identify significant issues and concerns related to the proposed action, a public scoping meeting was held in Big Timber, Montana, on June 28, 1990. Comments, suggestions, and concerns about the project and associated EIS were gathered. In addition to the comments received at the public meeting, written comments were also received during the scoping process. A complete discussion of scoping concerns is on

file with DSL and GNF. Appendix A lists issues and concerns brought up during the public scoping process. A brief summary of these issues and concerns is presented in Table 1.5-1. The issues and concerns raised by the public during scoping were used in the development of alternatives and were addressed in the analysis for the EIS.

The draft EIS was published and released to the public on May 7, 1991. The Notice of Availability appeared in the Federal Register on May 10, 1991, starting the official 45-day public comment period on the draft EIS. After the publication of the draft EIS, SPGMR proposed an alternate method of accessing the mine ore body. The agencies considered this a "substantial change in the proposed action that is relevant to environmental concerns;" therefore, a supplemental draft EIS was prepared and released to the public on August 12, 1991. The Notice of Availability appeared in the Federal Register on August 30, 1991, and the comment period for both the draft EIS and the supplemental draft EIS was extended to October 15, 1991.

Public meetings were held in Big Timber, Montana on June 5, 1991 and September 11, 1991 to accept public comments on the draft EIS and supplemental draft EIS. Transcripts of comments from these meetings are included in Chapter Six.

The DSL and GNF received 44 comment letters on the draft EIS and supplemental draft EIS as well as oral comments at the public meetings. A listing of commentors and copies of the letters and transcriptions are presented in Chapter Six. Specific, comments that have been addressed by the agencies are identified on each letter or transcribed testimony. Responses to these comments are found in Section 6.1.3.

Major concerns expressed by the public focused on degradation of surface and groundwater, reclamation, traffic, and socioeconomics. Revisions and additions have been made to the text in this FEIS to address these concerns where appropriate. The agencies have identified their preferred alternatives in this FEIS (see Section 2.8).

TABLE 1.5-1

ISSUES AND CONCERNS
EAST BOULDER MINE PROJECT

| Resource Area | Summary of Issues and Concerns |
|---|---|
| Socioeconomics | Concern was expressed over the change in lifestyle; the ability of the community to support the increase in population; employment; housing; crime; property values; and the effects on the existing and future economy. |
| Roads and Transportation | Concern was expressed over increased traffic from commuting mine workers, service equipment, and ore hauling; safety; dust control; noise; alternative access routes; financial responsibility for road maintenance and improvements; transportation impacts to wildlife, aesthetics, recreation, and ranching; and parking. Potential impact to residents of the East Boulder River valley were of particular concern. |
| Surface and Groundwater | Concern was expressed over water quality degradation, water monitoring specifications, water rights, spill control, the potential of acid forming from the adits, the potential dewatering of surface water bodies during mine tunneling, and the toxicity of reagents from the tailing impoundment. |
| Air Quality and Noise | Concern was expressed over the effects on air quality, particularly emissions and dust, as well as the effects of noise pollution. Questions were asked about filtering provisions, the extent of noise pollution, and impacts on wilderness experience. |
| Wildlife, Fisheries, and Vegetation | Concern was expressed over potential impacts to threatened and endangered species, weed control, potential increase in poaching, need for wildlife monitoring, increased road kills, effects on hunting and fishing opportunities, and possible decline in income from hunting and fishing due to fewer tourists coming into the area. |
| Recreation and Visuals | Concern was expressed over access to the backcountry, reduction in recreation opportunities (including motorized recreation), parking from recreationists, and the visual effects of the new powerline and tailing impoundment. |
| Land Use | Concern was expressed over whether development would stay in one location or move around, possibly affecting grazing permits in the future. |
| Geology | Concern was expressed over the possible failure of the tailing dam in the event of an earthquake. |

TABLE 1.5-1
(Concluded)

| Resource Area | Summary of Issues and Concerns |
|---|---|
| Reclamation | Concern was expressed over reclamation potential, bonding, permanent waste rock piles, and the leaving of buildings at mine closure. |
| Health and Safety | Concern was expressed over the possible lack of safety considerations during construction of the tailing dam, and the need for emergency plans for solid and liquid spills, underground volumes, shutdowns, fire, accidents, evacuation, and traffic. |
| Permit Procedure | Concern was expressed over the lengthy amounts of time involved in the permit process and who the decision makers are. |

This chapter summarizes the proposed mine and ore processing project as described by Stillwater PGM Resources (SPGMR). Alternatives to the proposed action, including a No Action Alternative, are also described. The first section of this chapter, Development of Alternatives, describes how the agencies developed the alternatives described and analyzed in this Environmental Impact Statement (EIS). The next section describes the No Action Alternative whereby a permit application for mine and mill development is not approved. The No Action Alternative is basically a projection of the present exploration activities into the future. Section 2.3 summarizes the SPGMR proposal. Modifications to the SPGMR's proposal are presented in Section 2.4, including alternatives for road access to the mine site, tailing impoundment design, power corridor siting, and prevention of surface water and groundwater degradation. Mitigation measures developed to alleviate environmental and/or socioeconomic impacts of the proposal are discussed in Section 2.5. Section 2.6 describes a change in the plan for the project as proposed by SPGMR. This change was proposed after the release of the draft EIS in May 1991, and was addressed in a supplemental draft EIS, released in August 1991. Other development activities occurring in the Gallatin National Forest (GNF) and/or near the proposed project area, or in a location that could contribute to overall environmental impacts are described in Section 2.7. Section 2.8 identifies the agencies' preferred alternatives.

## 2.1 DEVELOPMENT OF ALTERNATIVES

Consideration and evaluation of alternatives to the proposed action are required by the Montana and National Environmental Policy Acts (NEPA) and guidelines of the Council on Environmental Quality. The reason for this policy is that some aspects of the proposed action may impact the environment such that consideration of other alternative actions is worthy to minimize or even eliminate an impact. Also, rules to prevent degradation of groundwater and surface water, as regulated by the Department of Health and Environmental Sciences (DHES), require consideration of alternatives that would result in no water degradation or at least reduce the amount of degradation.

Alternatives have basically been developed in one of three manners. First, SPGMR identified preliminary alternatives for road access to the site and for transmission line siting based on known social and/or environmental concerns. SPGMR selected a preferred alternative for road access in the permit application, which will be considered in the following description of "SPGMR Proposal." However, specific details regarding transmission line routing were not included in the Plan of Operations, and follow-up correspondence and communication have been used to identify SPGMR's preferred route.

Second, the Montana Department of State Lands (DSL) and GNF used a "scoping" process to solicit additional concerns that the public or other regulatory bodies may have with the proposed action. The project ID Team, composed of specialists from DSL, GNF, and consultants in each of the environmental resource areas evaluated in this study, made preliminary identifications of alternatives during the permit application completeness reviews and baseline data evaluations. A scoping meeting to kick off the EIS was held in Big Timber on June 28, 1990. The objective of this meeting was to inform the public of the project proposal and solicit community, group, or individual concerns about any aspect of the mine plans. (More information regarding public input to alternatives development and refinement may be reviewed in Appendix A and Chapter One of this EIS).

Project scoping suggested that much of the concern over impacts focused on transportation issues, particularly road access. Potential road siting alternatives were identified by the public for road access. Also stability of the tailing impoundment was identified during scoping as an area of concern. An alternative tailing impoundment configuration has therefore been added to this study for analysis.

Third, DSL and GNF used the baseline data submitted by SPGMR and collected during the early stages of this EIS, and used concerns expressed during the scoping process to refine alternatives, which were then evaluated in detail for environmental benefits and consequences.

The significant issues identified during project review and public scoping, which led to alternatives analysis, have been identified as follows:

- Roads and Transportation. Many concerns were expressed during public meetings and in correspondence addressed to the agencies regarding roads and transportation. Issues identified include impacts of increased traffic from commuting mine workers; service equipment and ore haulage needs; safety; dust control; noise; financial responsibilities for maintenance, improvement, and snow plowing; impacts of increased traffic on wildlife, aesthetics, recreation, and ranching; and parking. By far the greatest concern was expressed over the varied impacts on persons residing near or ranching/farming along SG 31, the existing county road from just southeast of McLeod to the Forest Service boundary, a distance of about 8 miles. Alternatives presented in this section for alternate mine access routes were developed by SPGMR as part of the permit application, by various citizens and citizen advocacy groups, and by DSL and GNF.

  Implementation of Alternatives R1/R2. Condemnation rights were also questioned in the context of implementation of the road alternatives. Alternative R2 analyzes the effects of the use by the applicant of a new right-of-way across private lands. The implementation of this alternative would require acquisition of this right-of-way. The public has raised the issue of condemnation authority with regard to the acquisition of the new right-of-way. However, acquisition of the right-of-way by other means, including purchase of an easement or right-of-way in fee, is also possible. Alternative R1 analyzes the use by the applicant of the existing county road. The public has raised the issue of condemnation authority with regard to the possible need to widen the right-of-way and the potential for an inverse condemnation action based on the applicant's use of the road. The purpose of this EIS is to describe the environmental impacts associated with the road alternatives, including the social considerations raised by the public. The impacts of the road alternatives are fully described in Chapter Four. It is not the appropriate purpose or intent of this EIS to determine whether condemnation authority could or would be exercised or to determine whether certain parties would have an action for inverse condemnation. However, the following is a brief explanation of the state law regarding condemnation.

  Eminent domain, commonly called "condemnation," is defined in 70-30-101, MCA, as "the right of the state to take property for public use." The reference to "the state" merely means that the state has by statute authorized the condemnation. Any person who is entitled to make "public use" of a property is entitled to bring a condemnation action. "Public use" as defined in 70-30-102 MCA. Section 70-30-102(3) includes county roads in the definition of "public use." Therefore, a county may condemn property for use as a county road. Implicit in this power is the power to condemn property to widen a county road. Section 70-30-102(5) includes roads for working mines, mills, or

smelters as "public uses." Therefore, under state statute, the applicant may also have the power of eminent domain to condemn property for use to access a mine. However, condemnation can only be undertaken under the laws of the state. Specifically, 70-30-11 identifies the findings that must be made before property can be taken. Condemnation is exercised by filing an action with the court. The court determines whether the state's statutory mandates are met to enable the property to be taken. This EIS, the application, and agency responsibilities under the Metal Mine Reclamation and the MEPA and the National Environmental Policy Act (NEPA) do not determine an applicant's or county's right to condemn lands. Interpretation and application of condemnation rights is a complex issue that can only be resolved by the courts. The probability of success cannot be determined by the agencies.

Inverse condemnation is an action created by the courts to reimburse a landowner for diminution in the value to his or her property when the party responsible for the diminution does not bring a condemnation action. As an issue, inverse condemnation is even more complex than condemnation. Site-specific circumstances have a significant affect on the determination of who has what rights. Because the interpretation of circumstances and these statutes is the role of the judicial system, the agencies have not speculated on these issues in this document.

- Power Supply - The mine facility would need approximately 8-10 megawatts of electricity for daily operation, within the mill as well as inside the adit and workings. No power supply is currently available that extends to the project area. SPGMR identified potential power routes to the project area that are the same as existing corridors for roughly two-thirds of the total distance; alternatives have been developed for power delivery for the remainder of the route to the so-called Duck Creek Tap, north of the Yellowstone River. Specific issues of concern have been difficult to identify because of a lack of baseline data for the power line alternatives. Generally, acknowledged problems with new power lines can include easement acquisition, site accessibility, and impacts to aesthetics, wildlife, and soils. A specific route has yet to be acquired for a portion of the power line corridor described as segment 3. A specific route would be acquired through private lands by the power company through procurement of easements on private lands. General impacts of power line development on this segment are known and disclosed in this document in Chapter 4. Site-specific impacts within segment 3 are not known at this time due to lack of an acquired route; however, impacts to cultural resources, streams, and soils in this portion of the corridor would be assessed by the power company prior to beginning construction activities. The power company would consult with the Montana State Historic Preservation Office (SHPO) prior to ground-breaking activities and would comply with the direction provided by SHPO.

- Tailing Impoundment Dam - SPGMR has proposed a tailing dam with an outside slope angle of 1.6(horizontal):1(vertical), to be constructed largely of boulders, cobbles, and soils excavated during impoundment and surface facilities development. DSL and GNF initially expressed some reservation about the relatively steep nature of the dam face compared to other approved and/or reclaimed tailing dams in the State of Montana. Additional concern was identified in the scoping process regarding slope stability, visual impacts, and reclamation of the tailing impoundment. Comments included concern over the response of the tailing dam and pond to a large earthquake; tailing dam revegetation and overall reclamation plans; and aesthetic disruption of the surrounding area due to the probable talus-slope-like nature of the reclaimed product. In response to these

issues, DSL and GNF developed an alternative for the tailing impoundment that would reduce the pitch of the dam to a 2(H):1(V) slope.

- Degradation of Surface Waters and Groundwater - The agencies have determined that SPGMR's proposed action would degrade the quality of the East Boulder River and groundwater in the vicinity of the mine and mill facilities. The evaluation conducted for this EIS indicates that the amount of degradation would not exceed criteria established for drinking water. Numeric criteria for protection of aquatic life would not be exceeded, but nitrogen concentrations under the SPGMR's proposal could lead to growth of undesirable aquatic life. Alteration of the quality of these waters by an increase in nitrates and/or heavy metals would violate Montana's nondegradation rules (ARM 16.20.701 et seq and 16.20.702 et seq). The agencies have, therefore, developed a set of water treatment alternatives that would reduce the amount of water degradation caused by mine water discharge and the facility sewage disposal system. These alternatives provide an indication of the effectiveness of various water treatment technologies at minimizing impacts to surface waters, but a particular treatment technology may not be identified as preferred by the agencies, for the following reason.

  SPGMR has submitted a Petition for Modification of the Quality of Ambient Water (April 1991) in the East Boulder River to the Board of Health and Environmental Sciences (BHES). A summary of the information presented in SPGMR's petition may be found in Section 2.3.6.6 of this EIS. The Water Quality Bureau determined the petition complete and the BHES decided at its August 23 meeting to participate in this EIS. This EIS has been expanded, in part through the consideration of potential water treatment technologies, so as to provide the BHES with a full evaluation of the need for and the impacts of granting such a decision.

  The Board will hold a formal public hearing on the petition and a decision to grant or deny the petition may either be made at that time, or, not later than the BHES's next regularly scheduled meeting. The BHES may allow degradation of state water based on necessary economic or social development but in no case may degradation be allowed that will preclude any present or future beneficial use. Following BHES action a statement of reasons for granting or denying the petition will be issued.

A range of alternatives has, therefore, been compiled primarily in four areas of concern, which can be grouped into four main categories: No Action, Proposed Action, Proposed Action with Alternatives, and Proposed Action with Modifications. Each of these are discussed below, including an overview of the specific analyses conducted for road, power, tailing dam, and water degradation alternatives, and a rationale for conducting or not conducting a detailed analysis of each alternative. Table 2.1-1 summarizes key implementation requirements for each alternative.

## 2.2 ALTERNATIVE 1 - NO ACTION

The No Action Alternative is evaluated as a baseline case of existing and future conditions in the project area as required by Council on Environmental Quality guidelines. Under this alternative. SPGMR would not receive a permit to develop the East Boulder Mine Project. Conditions described in Chapter Three, Affected Environment, would continue to exist unchanged by activity relating to this mine proposal.

TABLE 2.1-1

SUMMARY TABLE OF ALTERNATIVES

| | Alternative | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Type of Activity | 1 | 2 | 3 | 4A | 4B | 5A | 5B | 6 | 7 | 8 |
| Mine Development | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| New Roads (miles) | 1.0 | 2.6 | 2.6 | 9.1[a] | 9.6[a] | 4.0[a] | 3.5[a] | 2.6 | 2.6 | 2.6 |
| Road Upgrade (miles) | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| permit area Disturbance (acres) | 30 | 233[d] | 233[d] | 233[d] | 233[d] | 233[d] | 233[d] | 233[d] | 233[d] | 230[d] |
| Tailing Pond (acres) | <1 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| Tailing Dam Slope | N/A[c] | 1.6:1 | 2:1 | 1.6:1 | 1.6:1 | 1.6:1 | 1.6:1 | 1.6:1 | 2:1 | 2:1 |
| Miles Powerline | 0 | 12-15 | 12-15 | 12-15 | 12-15 | 26-29[b] | 25-28[b] | 12-15 | 12-15 | 12-15 |
| Miles New Power Corridor | 0 | 2.6 | 2.6 | 2.6 | 2.6 | 5.7 | 4.5 | 2.6 | 2.6 | 2.6 |
| No. of Stream Crossing - Including Upgrades | 7 | 7 | 7 | 7 | 8 | 7 | 7 | 7 | 7 | 7 |

[a] Includes 2.6 miles of new road in forest
[b] Includes 12-15 miles McLeod to mine site
[c] NA = Not applicable
[d] Acres of Disturbance could increase by up to 20 additional acres to accommodate proposed mitigation.

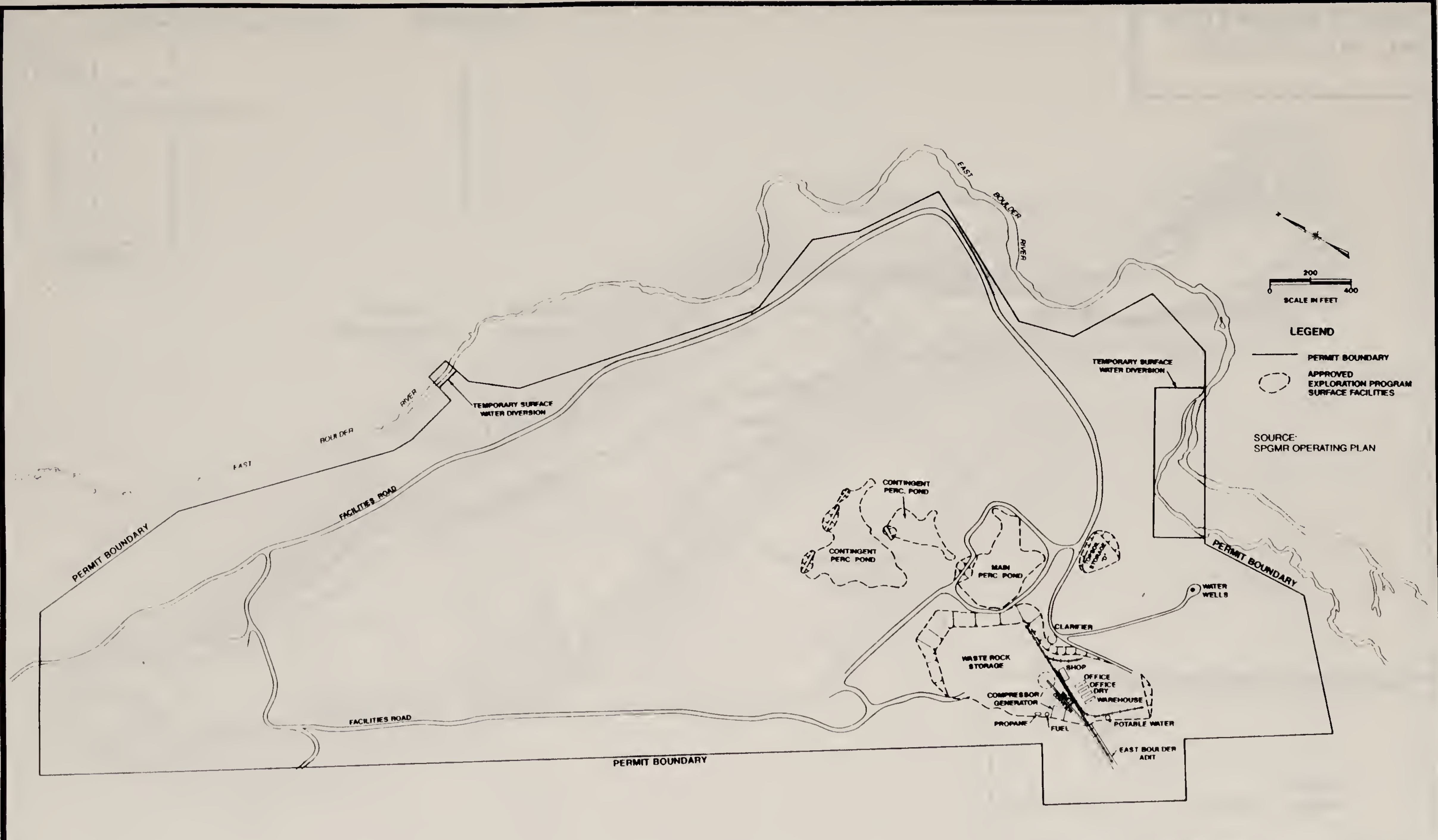
The No Action Alternative implies that the existing condition of the environment will remain undisturbed by activities associated with the mine project. However, the "baseline" evaluated for this EIS does not necessarily reflect current environmental conditions. This is because SPGMR has valid exploration permits, issued by the Big Timber Ranger District and DSL, for mining exploration activities in the project area (See Jackpine Project Exploration Adit Decision Notice and Finding of No Significant Impact, 1/12/88, Appendix B). Some of the activities allowed under this permit are excavation of the East Boulder exploration adit, development of exploration support facilities, construction of an access road to the portal area, installation of settling ponds for wastewater from the adit, and eventually reclamation (Figure 2.2-1). The decision reached in this EIS will have no legal impact on SPGMR's exploration activities. SPGMR will be allowed to continue already permitted exploration activities or close down the exploration activities and rehabilitate the surface disturbance in conformance with terms of the exploration permit issued. Therefore, the baseline environmental conditions evaluated in this EIS assume these modifications have taken place.

## 2.3 ALTERNATIVE 2 - PROPOSED ACTION

The following description of the proposed East Boulder Mine Project is largely based on Chapter 1.0, Project Summary, and Chapter 3.0, Operating Plan, of the Plan of Operations submitted by SPGMR with the mine permit application. Additional information has been added where clarification is needed; however, the summary below is quite succinct compared to the level of detail in the Plan of Operations. For the complete project description as proposed by SPGMR, the reader is referred to the Plan of Operations, February 1990, as supplemented.

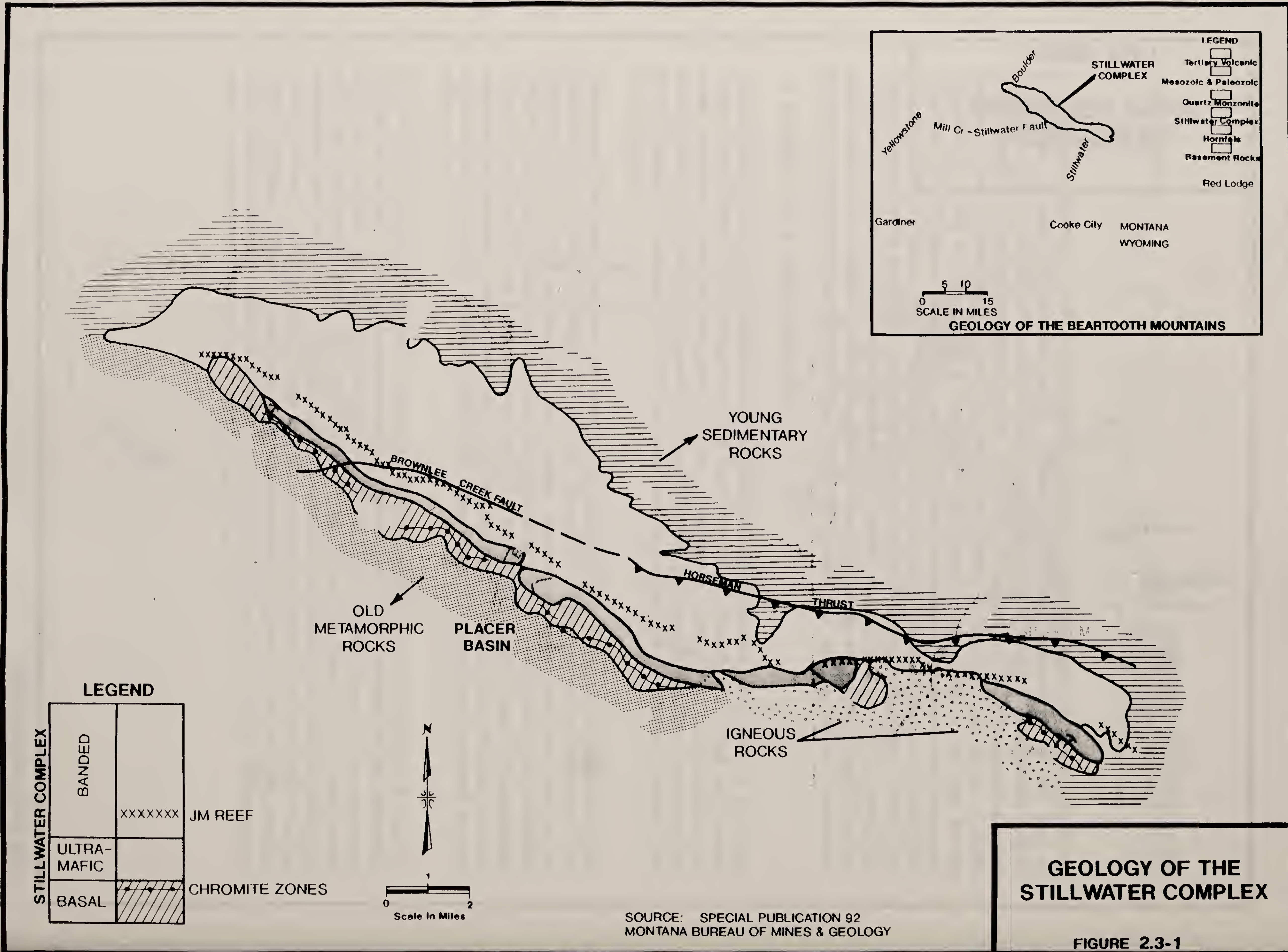
The proposed East Boulder Mine Project would be the second platinum/palladium operation brought into production on the Stillwater Geologic Complex (See Figure 2.3-1). Stillwater Mining Company's (SMC) Stillwater Mine is currently operating near Nye, Montana. Exploration activities in the Frog Pond area and along the East Boulder Plateau in the vicinity of the proposed project area have revealed many similarities to the section of the J-M Reef now being mined by SMC at the Stillwater Mine. Because of the similarities in ore and waste mineralogy, mining conditions, facility requirements, mining and milling methodologies, and environmental concerns, the proposed East Boulder Mine Project has been closely patterned after the Stillwater Mine.

The East Boulder Mine Project would consist of an underground mine, an ore processing mill, a surface mine and mill support complex, a tailing retention impoundment, and other secondary facilities required to support the operation. The majority of the surface facilities would be located adjacent to the main access adit in the East Boulder River valley on SPGMR mill site claims (See Figure 2.3-2). Other surface construction would be located on SPGMR patented or mineral lode claims. The proposed permit area would encompass a total of approximately 844 acres in three separate locations (See Figure 2.3-3). The total area of disturbance within the permit area would be approximately 233 acres. Locations of the proposed surface facilities are within portions of Sections 2, 3, 11, 19, 26, 28, 29, and 34, T4S, R13E. A summary of permit boundaries and disturbed areas in acres is found in Table 2.3-1.




# JACKPINE EA FACILITIES PLAN

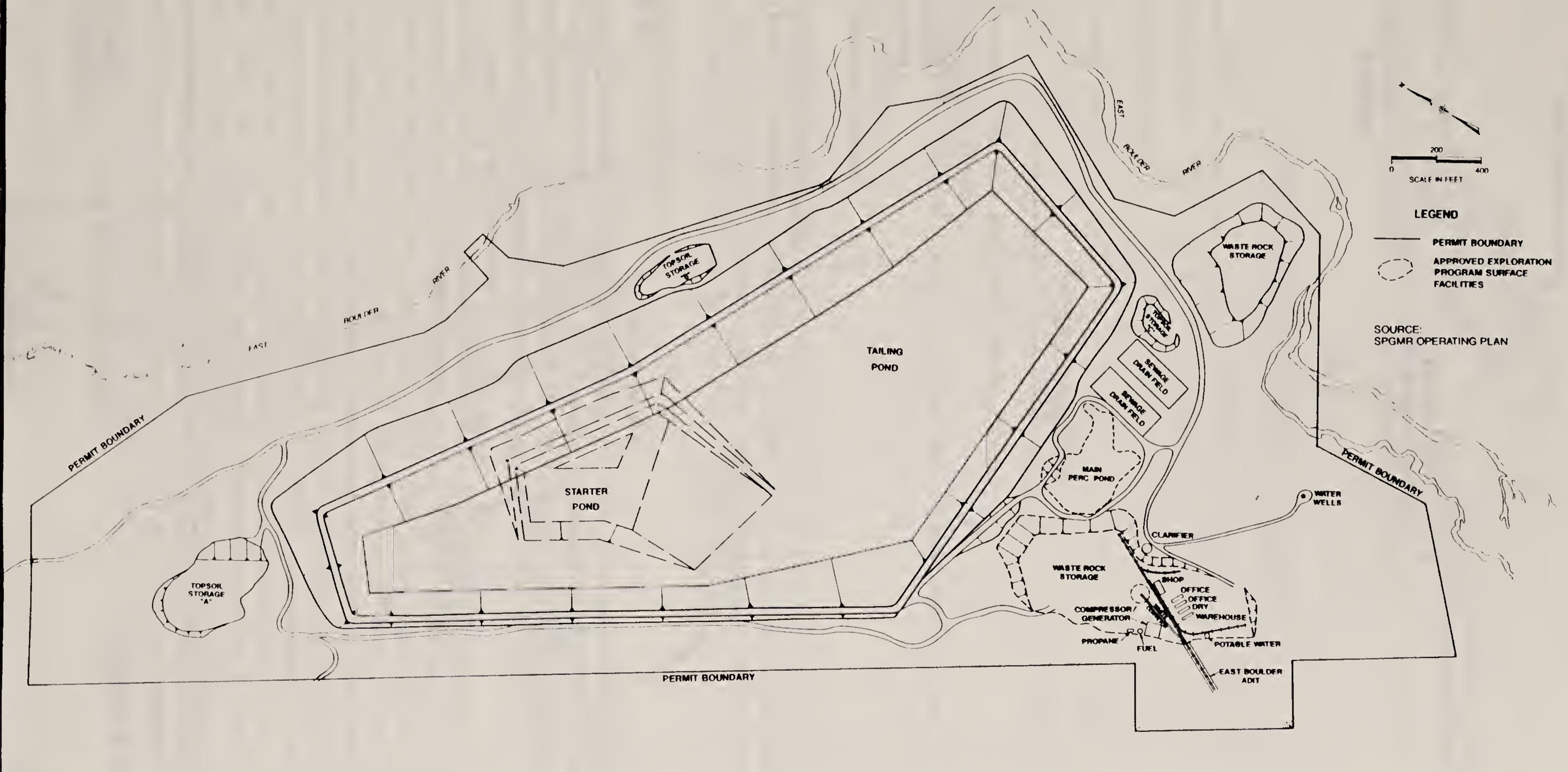
FIGURE 2.2-1




SOURCE: SPECIAL PUBLICATION 92
MONTANA BUREAU OF MINES & GEOLOGY

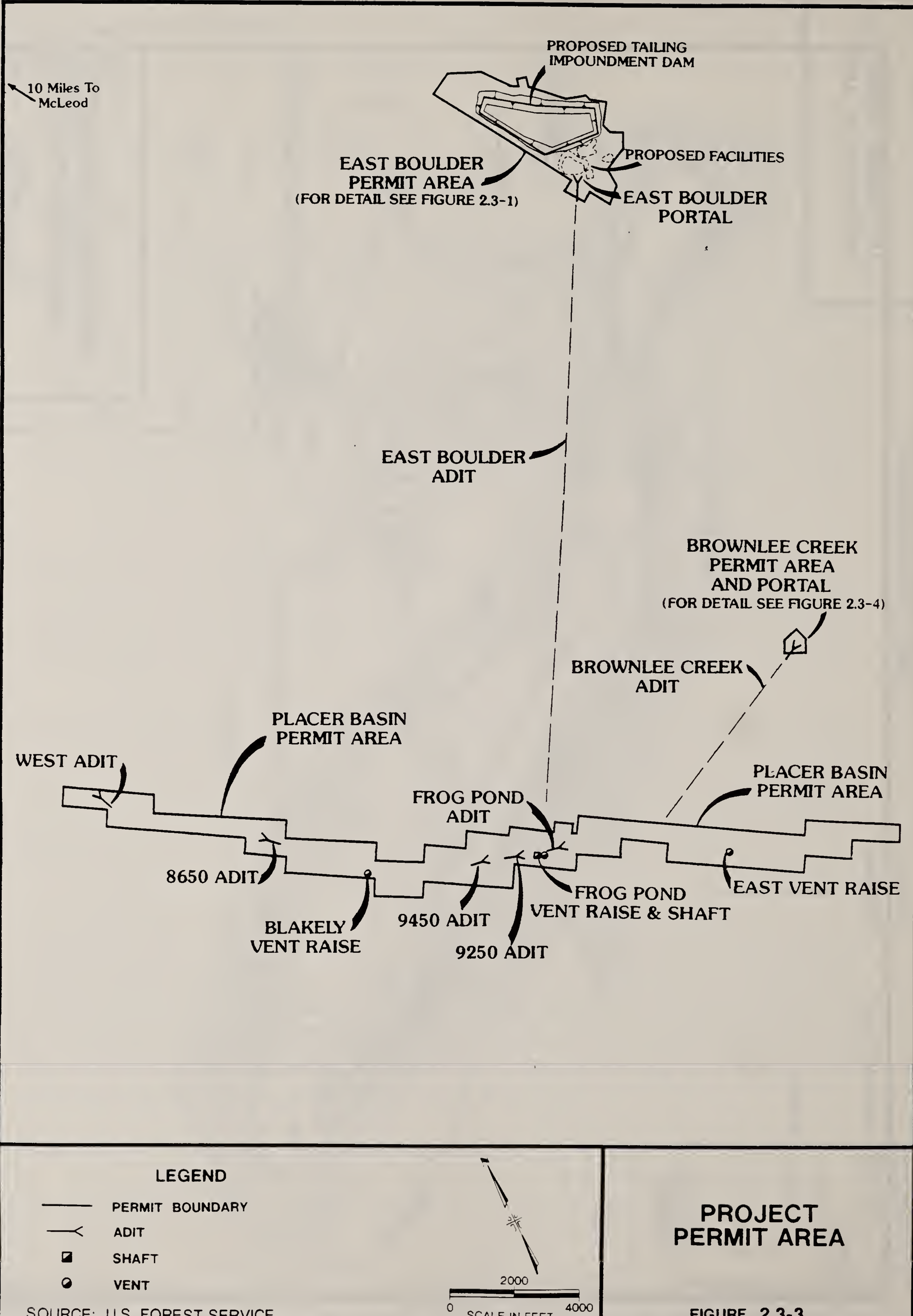
**GEOLOGY OF THE STILLWATER COMPLEX**

FIGURE 2.3-1




**PROPOSED PROJECT FACILITIES PLAN**

**FIGURE 2.3-2**




SOURCE: U.S. FOREST SERVICE

PROJECT PERMIT AREA

FIGURE 2.3-3

TABLE 2.3-1

SITE SUMMARY OF PROJECT ACREAGES

| Site | permit area | Disturbed Area |
|---|---|---|
| East Boulder permit area | 260 | 200 |
| Brownlee Creek permit area | 4 | 3 |
| Placer Basin permit area | 580[a] | 30 |
| TOTAL | 844[b] | 233[b] |

[a] Includes approximately 575 acres of patented mining claims.
Source: SPGMR Plan of Operations
[b] Under some sewage and wastewater treatment options, up to 20 additional acres may be disturbed.

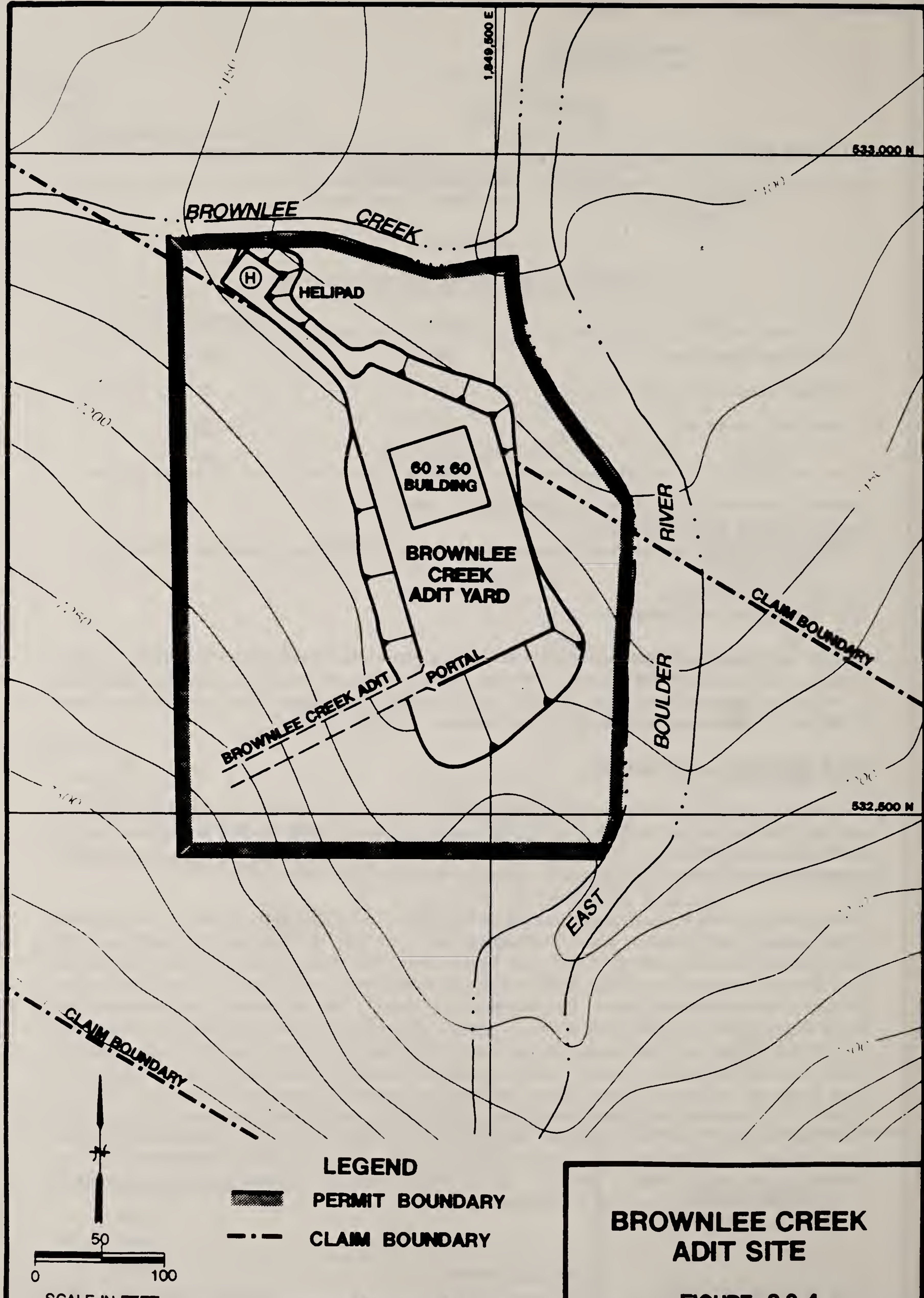
### 2.3.1 Mining Plan and Methods

Underground mining methods would be used to develop and mine the East Boulder Mine Project. A series of shafts, adits, bore holes, and raises would be used to access the deposit and provide necessary facility links to the surface. A total of seven adits, one shaft, and three ventilation borings (raises) are presently planned by SPGMR to be installed over the life of the operation.

#### 2.3.1.1 Mine Access and Ventilation

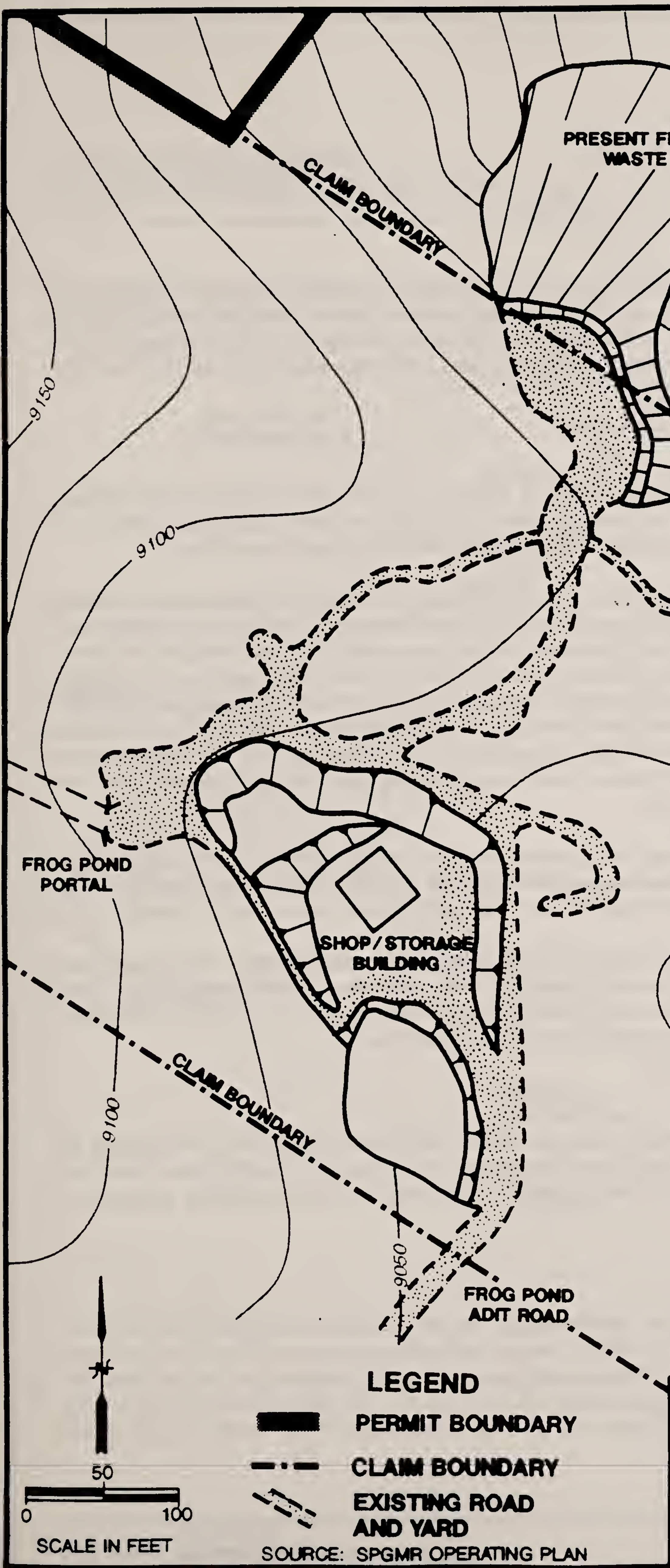
The primary mine access would be the East Boulder adit. The adit portal would be located adjacent to the mill and other related surface facilities. This adit would be approximately 16.0 feet in diameter, begin at an elevation near 6,350 feet, driven at a gradient of +0.5 to +1.0 percent (slightly uphill boring), and have a length of approximately 18,550 feet from surface to the intersection with the reef.

Other openings would be installed as development continues. The second opening would be the Brownlee Creek breakout which would be driven from underground to a surface breakout near the confluence of the East Boulder River and Brownlee Creek (See Figure 2.3-4). This facility would serve as the second exit from the mine required by the Mine Safety and Health Administration (MSHA). It would also complete the primary mine ventilation circuit. The Brownlee Creek tunnel to the adit would be approximately 5,640 feet in length, driven at a gradient of about +12 percent, and intersect a surface outcrop near the elevation of 7,160 feet. Remaining shafts, adits, and ventilation raises would be installed once the mine workings are within a reasonable distance of surface to allow installation. Another planned shaft is in the vicinity of the Frog Pond adit, which was driven during underground exploration activities in 1980 and 1981 (See Figure 2.3-5). Two other adits would be required to access ore reserves in the central portion of the reserve block near the Frog Pond site, but neither are expected to be required until later in the mining program. Remaining mine development facilities would consist of a series of three or more ventilation raises and two ventilation and escape adits to surface. These facilities would be required to alleviate ventilation inefficiencies that will arise as mine development expands.




BROWNLEE CREEK ADIT SITE

FIGURE 2.3-4




FROG POND
ADIT SITE

FIGURE 2.3-5

Adits would also provide necessary alternate emergency escape routes to the surface. These facilities would be installed once the mining operation is close enough to the surface to allow a boring machine to be used to construct the raises or, for the adits, to be driven from the mine workings to surface breakout. In the case of the raises, conventional raise mining techniques or other technology may be employed to drive the raises from underground.

#### 2.3.1.2 Cut-and-Fill Mining

SPGMR has indicated that a "cut-and-fill" method of mining will be employed, although other mining techniques such as shrinkage stopping may be used where applicable or as new technology evolves. An explanation of the cut-and-fill method as proposed for the East Boulder Mine Project follows.

Stopes (an underground area of excavation and ore extraction) would be located by diamond-core drilling the reef from the footwall lateral, which is the main non- or low-ore bearing rock immediately adjacent and below the ore-bearing zone. A "typical" stope is expected to be approximately 150 feet in length and extend vertically 150 to 200 feet to the next level. Once delineated, each stope would be accessed by a 100- to 200-foot-long cross-cut driven from the footwall lateral to the base of the stope. The stope would then be mined from a central raise driven in the reef from the access cross-cut to the level above. This raise would contain a manway for personnel access and a timberslide compartment for materials and supplies conveyance and stope utility feed lines. One or more ore chutes would be installed with stope advance to transfer ore from the stope to the level below (Figure 2.3-6).

Stopes would be mined from bottom to top taking a series of approximately nine-foot-high horizontal slices or floors. After each floor is mined, the opening would be filled with mill tailing. The tailing fill would stabilize the stope walls and provide a working surface from which the next floor would be mined.

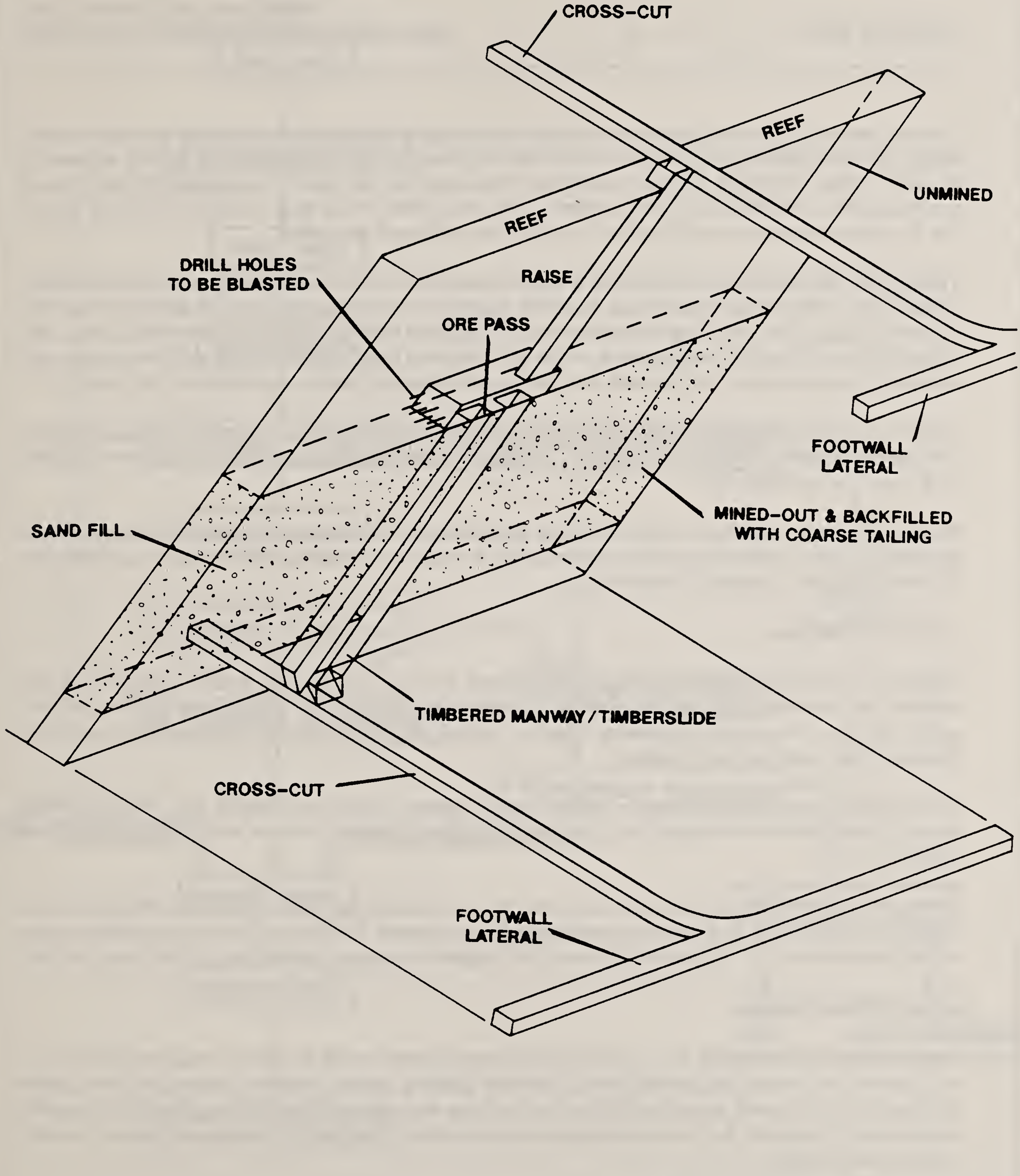
The tailing fill would consist of the coarser fraction of mill tailing produced by cycloning the tailing stream at the mill. The sand slurry produced would be pumped to an underground sand storage facility (sand plant). From the sand plant, the sand would be pumped as needed to the stopes. For further reinforcement, cement may also be introduced into the sand fill circuit at the sand plant.

#### 2.3.1.3 Blasting

Blasting would be conducted as part of the mining operations. Types of explosives to be used include an ammonium nitrate fuel oil mixture and water gels, either as a pumpable slurry or in stick form. Except for the occasion when a new access facility is being installed or for other surface construction purposes, all blasting would occur underground.

### 2.3.2 Production

The mine ore production rate would be approximately 730,000 tons per year (2,000 tons per day). Production rate and life of the operation would be determined by the economic viability of the operation, which is a function of many variables including metal prices, ore grade, continuity of the ore zone, and production cost. SPGMR has estimated an operating life of 27 years. The daily production rate of 2,000 tons per day is the maximum reasonably foreseeable production rate based on foreseeable technology and production methods.




SOURCE:
SPGMR OPERATING PLAN

TYPICAL
CUT & FILL STOPE

FIGURE 2.3-6

Ore and waste rock produced from the mine would be transported to the surface via the primary mine entry facility, the East Boulder adit. The ore would then be concentrated in a flotation mill located adjacent to the adit. This mill would produce a flotation concentrate in the ratio of approximately one ton of concentrate for each 100 tons of ore processed. The concentrate would then be shipped from the project site by truck to the smelter in Columbus, Montana, for additional processing.

Tailing from the mill would be disposed in a lined impoundment located immediately north and west of the mill complex. The tailing impoundment would be designed to retain approximately 40 percent of the total volume of tailing. The remaining 60 percent would be returned underground for use as backfill in the stope mining process. The tailing impoundment would be constructed from mine waste rock and borrow materials excavated from the interior of the pond area, and would ultimately occupy approximately 105 acres.

Mine waste rock would also be used as a fill material in underground mined-out stopes or for miscellaneous construction purposes throughout the project. Surplus waste rock would be used in reclamation or disposed of in waste rock storage piles.

Major facility sites would be reclaimed following mine closure. In most cases, reclamation programs would be directed toward revegetating disturbed areas to allow re-use for recreation, wildlife habitat, and land uses that existed before to project development.

### 2.3.3 Ore Processing

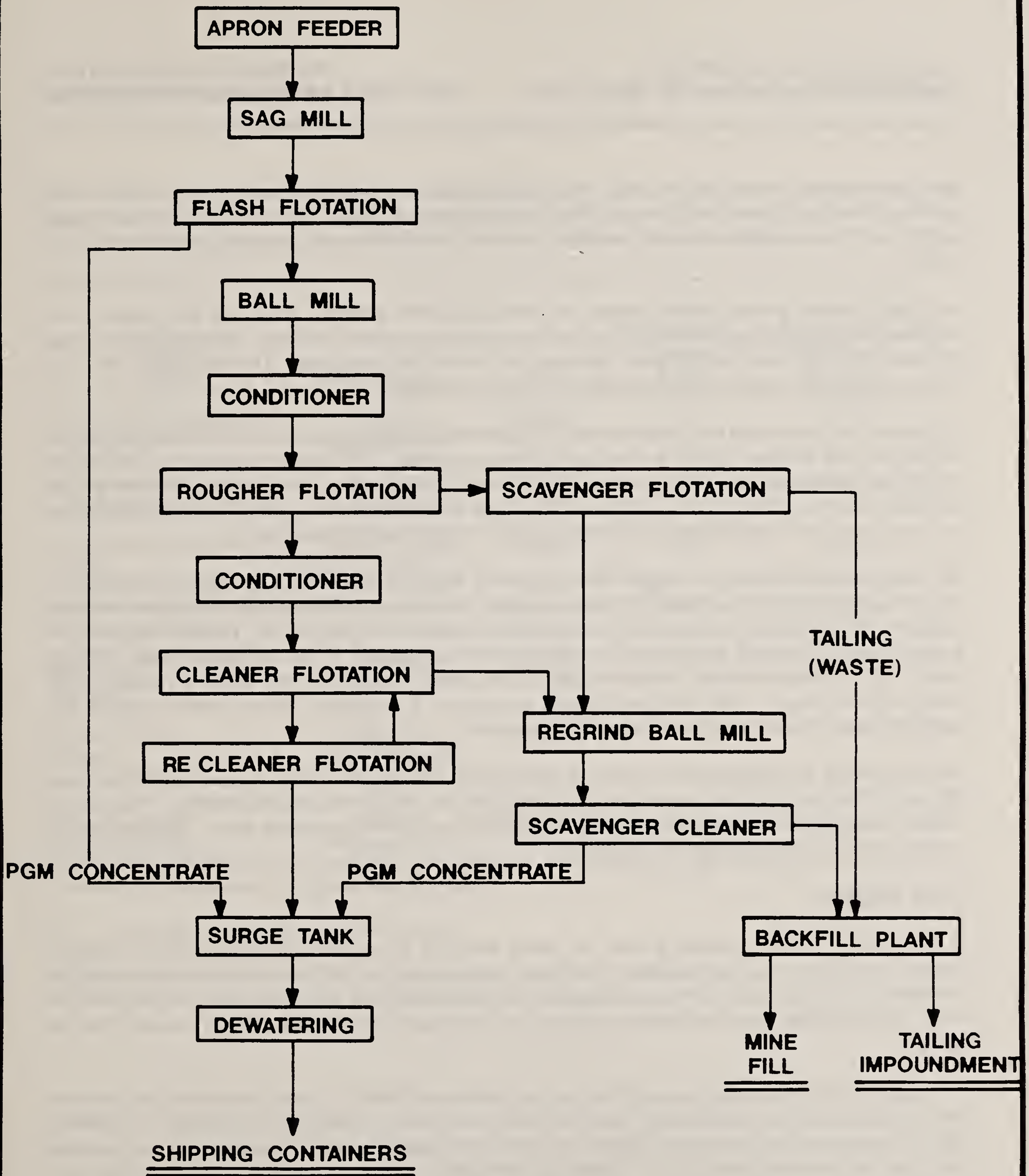
Milling is a term that encompasses the ore beneficiation process. For the East Boulder Mine Project, this includes size reduction (crushing and grinding), separation (flotation) of the sulfide minerals from the non-sulfide minerals, dewatering (thickening, filtering, drying, and packaging) of the concentrate, and final disposal of the waste minerals (tailing).

The East Boulder milling operations would be located adjacent to the East Boulder adit. The mill would include a small coarse-ore storage bin, a process building with product load-out area, and several support facilities.

The feed tonnage of coarse ore to the mill would be at a nominal rate of approximately 730,000 tons per year, which would result in the annual production of approximately 7,300 tons of flotation concentrate when at full production levels. The mill facility would be designed to operate between 345 and 365 days per year.

#### 2.3.3.1 Milling Method

From the surface ore storage bin, a feeder and conveyor system would be used to transport the ore to a small coarse ore storage bin located ahead of the mill grinding circuit. Referring to the flow sheet shown on Figure 2.3-7, an apron feeder would draw the ore from the bottom of the mill bin. The ore, along with process water, would be fed to the semi-autogenous grinding (SAG) mill, which would perform primary crushing and grinding.




SOURCE:
SPGMR OPERATING PLAN

MILL FLOW SHEET

FIGURE 2.3-7

The slurry discharge from the SAG mill would then be sent to a cyclone classifier. The overflow (fine particles) from the cyclone would be sent directly to the flotation circuit. The cyclone under-flow (larger particles and heavier sulfide minerals) would be sent to a flash flotation cell operating within the ball mill circuit.

The flash flotation process would remove the liberated sulfide minerals, containing the platinum and palladium, at a size coarser than would be released through the cyclone overflow. This concentrate would flow directly to the final product tank, bypassing the rest of the processing. The tailing from the flash flotation would be returned to the ball mill for secondary grinding.

The cyclone overflow would be conditioned with flotation reagents and separated into two fractions (rougher concentrate and rougher tailing) in the rougher flotation circuit. The rougher concentrate (an impure concentrate containing most of the platinum group metals (PGMs), the sulfide minerals, and some gangue minerals) would be cleaned in two stages by reflotation in the cleaner flotation cells. The concentrate from the second stage recleaner flotation cell would be placed in the final product tank.

The tailing produced from the rougher flotation circuit would be reprocessed by scavenger flotation to recover additional (but lower-grade) PGM and sulfide minerals. This scavenger concentrate would be combined with the tailing from the first cleaner circuit in a regrind ball mill circuit. This material would be ground further to liberate additional PGM values before retreatment in the scavenger-cleaner flotation circuit. The scavenger-cleaner concentrate goes to the cleaner circuit while the tailing is rejected to the tailing disposal system. The combined finished concentrate is dewatered, filtered, dried, sampled, and packaged before being placed in containers for shipment.

The tailing from the milling process would be sent directly either to the tailing pond or to the mine sand fill plant. The sand fill plant would take the tailing and size the slurry into two products. The coarser fraction would be sent underground for use as a backfill product in the stoping cycle. The fine fraction would be sent to the tailing pond for disposal.

#### 2.3.3.2 Reagents

In the flotation process, a finely ground ore slurry would be mixed with very small doses of reagents (Table 2.3-2). These reagents establish a condition on the surface of the desired minerals that would be favorable for the attachment of these minerals to air bubbles that have been introduced into the flotation cells. The air bubbles buoy the favorable minerals to the surface of the flotation cells for removal from the system.

The reagents that are currently proposed for use are presented in Table 2.3-2 and discussed in later sections. These reagents and the planned usage rates have been based on the technology developed at the Stillwater Mill. It is expected that the precise reagents and associated dosages would be modified over the operating life of the East Boulder Mine Project. Additional information on each reagent is presented in Appendix F of the Plan of Operations. There are three major classes of flotation agents: collectors, frothers, and modifiers. In addition, a flocculating reagent would also be used. A discussion of each type of reagent is included below.

TABLE 2.3-2

FLOTATION REAGENTS

| Reagent Name | Manufacturer | Use | Approximate Dosage lb/ton | Amount Used Per Year[a] (Pounds) |
|---|---|---|---|---|
| Potassium amyl xanthate AERO 350 | American Cyanamid Co. | Collector | 0.1 | 73,000 |
| Dithiophosphate AERO Promotor 3477 | American Cyanamid Co. | Collector | 0.1 | 73,000 |
| Methyl isobutyl carbinol Generic | Union Carbide Corporation | Frother | 0.06 | 43,000 |
| Carboxyl methyl cellulose AQUALON CMC-T | Aqualon Co. | Dispersant | 0.9 | 657,000 |
| Sulfuric acid Generic | ASARCO | Modifier | 0.8 | 584,000 |
| Copper sulfate Generic | CHEMAX, McCall Oil and Chemical | Modifier | 0.017 | 12,410 |
| Cationic polymer Photafloc 1137 | Neutron Products Inc. | Flocculent | 0.02 | 14,600 |

[a] Based on ore production of 730,000 tons per year

Source: SPGMR Plan of Operations, Table 3.3-1

Collectors

The flotation collector, along with other agents, produces a firm bond between the air bubbles that make up the froth and the mineral particles to be recovered. At the East Boulder Mine Project, the platinum and palladium is associated with copper and nickel sulfide minerals. Certain xanthates and dithiophosphates would be used as the collectors for these minerals.

Frothers

Reagents that aid the collectors in mineral particle entrapment by creating a temporary elasticity of the air bubble surfaces are called frothers. A methyl isobutyl carbinol frother is expected to be used at the East Boulder Mine Project.

Modifiers

The flotation agents classified as modifiers include: pH regulators, activators, and dispersants. A pH of approximately 7.8 would be maintained in the mill circuit by adding sulfuric acid. Copper sulfate would be used to activate the mineral surfaces, enhancing the effect of the collectors and reducing the required addition. The dispersant for the undesired minerals would be a member of the cellulose family called carboxymethyl cellulose (CMC). CMC has a variety of applications in industry ranging from a dispersant in milling operations to use as a specialized food additive in products such as ice cream.

Flocculents

The dewatering operation uses another type of reagent known as a flocculent. A flocculent forms attachments between the finely divided sulfides and PGMs in the concentrate to enhance the settling and filtering rates and to provide a clear decant solution.

The characteristics of the proposed East Boulder Mine Project milling reagents are listed below.

Potassium Amyl Xanthate

This compound is an anionic flotation collector used for sulfide mineral ores. This collector is the most important chemical in the flotation process because it is the reagent that produces a film on sulfide mineral particles and causes the particles to attach firmly to the rising air bubbles.

At the proposed usage rate of approximately 0.1 lb/ton of ore, the amount of xanthates expected to report to the tailing solids would be 0.0135 to 0.018 lb/ton processed. Zero to 0.0045 lb/ton are expected to report to the tailing as liquids, producing a total concentration of xanthates in the tailing water of less than 1.7 ppm. This is based on the generally observed conditions wherein 90 percent of the collector remains on the concentrate and 10 percent with the solution (90:10 relationship).

Ecosystem toxicological information for xanthates indicates a 96-hour $LC_{50}$ ($LC_{50}$ or $LD_{50}$ is an environmental concentration or administered dose at which 50 percent of the organisms dies in a specified period of time, often 96 hours) for rainbow trout (Salmo gairdneri) at 32 to 56 ppm (SPGMR 1990) and 70 to 80 ppm (Fuerstenau 1974). The chemical and biological degradation products of xanthates are sodium carbonate,

hydrogen sulfide, and carbon dioxide. The concentrations of hydrogen sulfide from this decomposition equation are approximately 50 times less than the 24-hr $LC_{50}$ for rainbow trout of 0.86 ppm (SPGMR 1990). Acute oral toxicity (i.e., causes death or extreme disorder immediately or shortly following exposure to contaminant) to laboratory rats is between 1.0 and 2.0 g/Kg (grams/kilogram).

Potassium hydroxide, a component of potassium amyl xanthate, is an acutely toxic and reactive chemical under Title III of the Superfund Amendments Reauthorization Act. If quantities used exceed 1,000 lbs per year at a 1.5 percent concentration, its use must be reported to the appropriate authorities for emergency planning purposes.

Dithiophosphate

This is an anionic secondary collector that enhances the flotation performance of the xanthate. SPGMR expects to use approximately 0.1 lb of dithiophosphate per ton of ore. The concentration of dithiophosphate in the tailing water is estimated to be 1.7 ppm (the 90:10 relationship referenced above).

Chemical and biological degradation products of this compound are not described by the manufacturer (Material Safety Data Sheet No. 0413-03, American Cyanamid, 3/8/89) but are expected to be hydrogen sulfide, carbon dioxide, and sodium phosphate and/or oxides of sulfur and phosphorous. Thermal decomposition or combustion (breakdown of the chemical during fire or high temperatures) may produce carbon monoxide, carbon dioxide, hydrogen sulfide and/or oxides of sulfur and phosphorous.

Acute oral toxicity to laboratory rats ($LD_{50}$) for a similar product is 3.54 g/Kg. Contact with acid may cause liberation of hydrogen sulfide. Overexposure to hydrogen sulfide may cause severe eye or respiratory tract irritation and other symptoms including respiratory failure and coma. Lower levels of hydrogen sulfide exposure may cause headache, dizziness, and other symptoms.

Sodium hydroxide, a component of dithiophosphate, is an acutely toxic chemical under Title III of the Superfund Amendments Reauthorization Act. If quantities used exceed 1,000 lbs per year at approximately a 0.5 % concentration, its use must be reported to the appropriate authorities for emergency planning purposes.

Methyl Isobutyl Carbinol

Methyl Isobutyl Carbinol (MIC) is a member of the alcohol family of chemicals, also known by the specific product name of Methyl Amyl Alcohol. Because of the good frothing properties of the dithiophosphate, MIC would not be used continuously. At the proposed usage rate of about 0.06 lbs/ton, about 1 mg/Kg of this compound would be expected in the tailing water.

Based on the manufacturer's indication that the product is rapidly biodegradable at low concentrations in water, SPGMR believes that the MIC expected to be used in the East Boulder mill will quickly biodegrade. Biodegradation products should be carbon dioxide and water. The main concern with this compound is that large, uncontrolled spills could deplete the oxygen in a treatment plant or be toxic to fish and other aquatic organisms if flushed or drained into surface waters.

Acute oral toxicity to laboratory rates ($LD_{50}$) is 2.6 g/Kg. Vapors from this compound may be irritating, and large concentrations may cause headaches or drowsiness. MIC can be moderately toxic, causing nausea, vomiting, and diarrhea. Irritation of the skin and eyes may occur when contacted.

Carboxymethyl Cellulose

This compound, also known as CMC, is prepared by the reaction of the cellulose hydroxyls of each anhydroglucose unit found on cellulose with sodium monochloracetate. Besides acting as a dispersant and protecting certain mineral surfaces against the action of other flotation agents, CMC also reduces the amount of the xanthate collector used in the process. The proposed usage rate of 0.9 lb per ton of ore would result in approximately 0.515 to 0.526 lb of spent chemical as insoluble solids per ton of tailing. The remainder of the chemical would be present as dissolved material in the tailing water resulting in estimated concentrations of 3.6 to 4.8 g/Kg.

The manufacturer (AQUALON COMPANY) reports that CMC is biodegradable (Material Safety Data Sheet No. 300 6000 0000-2, AQUALON COMPANY, 2/20/87). Wastewater containing this product can be considered for treatment in an acclimated biological treatment system of adequate capacity. This means that the chemical should not be toxic to the microorganisms responsible for the biodegradation. However, breakdown products have not been identified.

CMC may cause mild irritation when eyes are exposed to dust. CMC dust inhalation may also cause irritation of the respiratory tract. Toxicity dosage limits or threshold values have not been established for carboxymethyl cellulose.

Sulfuric Acid

Sulfuric acid ($H_2SO_4$) is used for pH control in the flotation process. Maximum usage is estimated at approximately 0.8 lb/ton to achieve an optimum process water pH of 7.8. At these usage rates, the resulting tailing liquid could have $SO_4$ levels of 180 mg/l and a pH of 8.0.

Sulfuric acid will typically breakdown/react to water and various sulfate minerals, depending on what minerals are present in the tailing. There should be no adverse biologic activity attributed to a pH of 8.0 and a sulfate concentration of 180 mg/l in the tailing.

Sulfuric acid can be an extremely hazardous chemical when placed in contact with many materials including water and various organic compounds. Sulfuric acid reacts with many metals, releasing hydrogen gas. It is considered highly toxic when inhaled, and corrosive to skin and other body organs.

Sulfuric acid is considered a hazardous waste. If there is additional spent product that does not go into the tailing impoundment or is not consumed during ore processing, it would require disposal in accordance with RCRA.

Copper Sulfate

Copper sulfate pentahydrate is a modifier that activates the sulfide and surfaces of the PGMs to the action of the collectors. It would be added at the rate of approximately 0.017 lb/ton. Because of the pH of the

system, any residual copper ions would form cupric hydroxide, which is insoluble in water. SPGMR indicates the concentration of copper ions in the tailing solution would be negligible, any available copper would be expected to bond as salts in the tailing.

Copper sulfate has an acute oral toxicity to laboratory rats of 300 mg/Kg, and a threshold value limit of 1 mg/$M^3$ based on copper. The chemical can be irritating to skin, eyes, and mucous membranes, and induces a toxic reaction when ingested.

Cationic Flocculent

The cationic flocculent, currently Photafloc 1137, would be added to the concentrate at the rate of 0.002 lb/ton, which is equivalent to 0.02 lb/ton of ore. SPGMR has suggested that the concentration in the tailing impoundment will be undetectable.

Although Photofloc 1137 does not have any published effects on human health, it does contain a residual compound called "Acrylamide," which is suspected of causing cancer in humans. The Occupational Safety and Health Administration has established a permissible exposure limit of 0.3 mg/$m^3$, and the American Council of Governmental Hygienists recommends a threshold value limit of 0.03 mg/$m^3$ for skin. Overexposure to Photofloc 1377 may cause mild eye irritation, irritation of the skin and dermatitis, and irritation of the digestive and respiratory tract.

### 2.3.3.3 Reagent Storage and Spill Control

Reagent storage and handling would be done in accordance with occupational safety and health standards as administered by the MSHA relating to the particular hazards outlined in the product information bulletins (found in Appendix F to the Plan of Operations). A rigorous project-wide safety implementation, education, and monitoring program would be an ongoing part of the operator training programs required by corporate policy and federal and state laws. SPGMR has a spill contingency plan on file in their Plan of Operations.

Spill control would be accomplished by providing containment at the reagent unloading, storage, and mixing areas. Spills in the plant would be contained and the product re-used in the process. Any spills or other waste not usable in the process would be disposed of in accordance with requirements of the Resource Conservation and Recovery Act, and state or local laws and regulations, as applicable.

### 2.3.3.4 Mill Process Water

Approximately 764 gpm of water would be required in the milling process circuit. Process water is expected to be pumped from the tailing disposal facility and supplemented with approximately 60 gpm of potable water (make-up water).

In the initial years of production or during low precipitation/high evaporation periods, mill make-up water could be supplied from the mine water discharge. If for some unforeseen reason, available mine water is not adequate, additional make-up would be pumped from on-site potable wells or extracted from the East Boulder River.

## 2.3.4 Tailing Disposal Facility

### 2.3.4.1 General Description

A preliminary engineering report and a geotechnical report for the design of the East Boulder Mine Project tailing impoundment has been completed by International Engineering Company (IECO) and is attached to the Plan of Operations as Addendum D. Based on these studies, the location and general layout of the proposed tailing disposal facility has been completed (Figure 2.3-2).

The East Boulder Mine Project tailing impoundment would be designed to store the fine fraction of the tailing not suitable for use as a mine backfill product. These fines amount to approximately 40 percent of the total tailing volume. From startup to full production, the annual tailing storage requirement would range from approximately 60,000 to 292,000 dry tons per year. Based on an average dry unit weight of approximately 70 pounds per cubic foot, annual storage capacities from about 63,000 to 309,000 cubic yards would be required. Approximately 7.2 million tons (7.6 million cubic yards) would be stored during the estimated 27-year operating life.

Tailing would be pumped from the mill to the surface sand plant or to the tailing impoundment for disposal. Reclaim water from the tailing impoundment would be recycled to the mill for use in the milling process and to supplement the sand fill system if needed.

The tailing impoundment embankment would be constructed of mine waste rock supplemented with borrow excavated from the interior of the pond. Waste rock would be placed on the embankment in continuous lifts. The downstream method of impoundment containment and construction would be used. The downstream method is a process whereby the core of the dam is fixed during initial impoundment construction. Once tailing within the impoundment has reached a certain level, the dam height is raised. During the dam raising, the outside slope and center line of the dam are extended farther downgradient (downstream) to provide the additional stability needed for a higher barrier and increased impoundment volume.

The crest of the initial dam would be set at an elevation of approximately 6,250 feet. The area of this dam would be less than 15 acres. Upon completion, the impoundment would occupy approximately 105 acres (80 acres inside), and, at a final crest elevation of 6,330 feet, would have a maximum height of about 140 feet. The embankment crest width for all stages would be 30 feet and the downstream embankment slope would be 1.6(H):1.0(V). The total volume of waste rock used for embankment construction has been estimated at 3.6 million cubic yards. A summary of the tailing impoundment characteristics is shown on Table 2.3-3.

### 2.3.4.4 Impoundment Hydrology

Surface Water Hydrology

Surface runoff water from the land area adjacent to the impoundment would be diverted around the impoundment by a permanent diversion ditch west of the impoundment and by small operational ditches installed throughout the embankment construction period. The total tributary area for runoff is equal to the area of the impoundment (105 acres) and the watershed area above the impoundment (182 acres).

TABLE 2.3-3

SUMMARY OF TAILING IMPOUNDMENT CHARACTERISTICS

| Characteristic | Initial | Final |
|---|---|---|
| Dam Crest Elevation (ft) | 6,250 | 6,330 |
| Maximum Dam Height (ft) | 50 | 140 |
| Dam Volume (cy) | 175,000 | 3,627,000 |
| Pond Storage Capacity (cy)[a] | 241,000 | 7,860,000 |
| Pond life (yrs) | 2 | 27 |
| Pond Area (acres)[a] | 9 | 79.5 |

[a] Values pertain to elevations 10 feet below dam crest.
Source: SPGMR Plan of Operations, Table 3.4-1

The impoundment freeboard would be sized to prevent overtopping during normal operations and at all times during construction. The freeboard would also be designed to prevent overtopping due to one-half the probable maximum flood (1/2 PMF) flow. This flood criterion was adopted from the U.S. Army Corps of Engineers, "Recommended Guidelines for Safety Inspection of Dams" (1977).

A water surface profile was developed for the East Boulder River (See Addendum D to the Plan of Operations). At the peak flow of 51,600 cfs (1/2 PMF), the maximum water surface elevations were computed to be below the toe elevation of the proposed tailing impoundment dam.

Tailing Liquid Quality

The quality of water seeping from the tailing impoundment is expected to be similar to the tailing liquid quality from the Stillwater Mine tailing impoundment (Appendix D of the Plan of Operations). A discussion of the mill and tailing pond water balance and water quality can be found in Sections 2.3.6.4 and 2.3.6.5.

The tailing impoundment would be lined with a low-permeability, 100-mil high-density polyethylene (HDPE) liner to minimize seepage from the impoundment into the underlying soils. At the end of the impoundment life when the pond area and depth are the greatest, a maximum seepage rate of 0.4 gpm is expected (equivalent permeability of $10^{-13}$cm/sec).

The impoundment bottom and upstream slope of the embankment would be prepared for liner placement by removing sharp rocks and placing six to eight inches of sand bedding over the exposed surface. All sand bedding material would be obtained from local sand borrow sources, from screened glacial till or mine waste rock, or a combination of these sources. The membrane would be placed in sections with each successive liner section spliced onto the preceding liner with the upper edge anchored into the embankment. Liner installation would be carefully supervised and quality control checks would be conducted to ensure the highest possible installation standard.

#### 2.3.4.2 Impoundment Foundation

The geotechnical investigation program was carried out in 1988 and 1989 to support preliminary engineering studies and design of the impoundment. The impoundment foundation evaluation program included geologic mapping, test pits, drilling, seismic refraction surveys, and laboratory testing. The results of these studies, presented in Addendum D to the Plan of Operations, show that the depth to bedrock from ground surface exceeded all boring depths (29-160 feet) and that groundwater was observed in only two borings at depths of 23 feet and 70 feet. The underlying soil consists primarily of dense silty sands, gravels, cobbles, and boulders of glacial till origin. The results of the exploration program indicate that neither bedrock nor groundwater would be encountered in any excavation required for development of the impoundment.

#### 2.3.4.3 Impoundment Stability

The upstream and downstream slopes of the impoundment embankments were analyzed for static and seismic stability during various phases of the tailing impoundment design. The impoundment is projected to be more stable than minimal acceptable engineering standards require, as indicated by the high safety factors shown on Table 2.3-4.

### 2.3.5 Waste Rock

Waste rock generated during normal mining activities would be used for underground construction, placed in suitable mined-out areas, or transported to the surface for disposal or use in project facility construction, tailing pond embankment construction, or other developmental purpose. If there is a surplus, a waste rock storage pile will be created. The East Boulder adit would be the primary route used for the transportation of waste rock to the surface, which would be carried on a conveyor system or in rail haulage cars. During adit construction the conveyor system and/or rail haulage system would be installed. Upgrades to the system would occur as necessary after the ore zone is reached.

The relatively small volumes of waste rock that would be produced from the other adits would be used locally for surface construction purposes (eg., portal yards, access roads, general site construction). Any surplus waste from mine development in the Placer Basin area would be disposed in the Frog Pond waste rock dump. Estimated mine waste rock production schedule is presented in Table 2.3-5.

### 2.3.6 Mine Water Use and Management

#### 2.3.6.1 Mine Water

All mine water would be discharged from the East Boulder adit. It is anticipated that this water would originate from one of three primary sources: (1) water-bearing fissures intersected during mine development, (2) potable water introduced from the surface for consumption and use in the mining process, and (3) decant water from the underground sand fill silos.

TABLE 2.3-4
TAILING IMPOUNDMENT STABILITY ANALYSIS

| Case | Load Condition | Embankment Stage | Slope | Minimum Acceptable Factor of Safety[b] | Minimum Calculated Factor of Safety[b] | Factor Safety for Deep Circle Failure[b] |
|---|---|---|---|---|---|---|
| I | End-of-Construction | Starter Dam | Upslope | 1.3 | 1.5[c] | 2.5 |
| II | End-of-Construction | Starter Dam | Downstream | 1.3 | 1.6[c] | 2.4 |
| III | Long-Term (Full tailing pond) | Starter Dam | Downstream | 1.5 | 1.6[c] | 2.4 |
| IV | Long-Term (Full tailing pond) | Final Dam | Downstream | 1.5 | 1.6[c] | 1.7 |
| V | Seismic[a] | Starter Dam | Downstream | 1.0 | 1.3[c] | 1.8 |
| VI | Seismic[a] | Final Dam | Downstream | 1.0 | 1.3[c] | 1.4 |
| VII | Steady-State Seepage | Final Dam | Downstream | 1.3 | 1.3 | 1.3 |
| VIII | Steady-State Seepage | Starter Dam | Downstream | 1.3 | 1.6[c] | 2.2 |

[a] Seismic coefficient = 0.1g
[b] Refer to Addendum D, Plan of Operations for development of criteria
[c] Infinite slope condition (shallow failure surface or ravelling)

Source: SPGMR Plan of Operations, Table 3.4-2

TABLE 2.3-5

ESTIMATED MINE WASTE ROCK PRODUCTION SCHEDULE

| Year | Total Annual Tons | Total Cum. Tons | Cum. Vol. (cy) |
|---|---|---|---|
| Pre-development[a] | 340,000 | 340,000 | 180,000 |
| 1 | 100,000 | 440,000 | 233,000 |
| 2 | 200,000 | 640,000 | 339,000 |
| 3 | 300,000 | 940,000 | 498,000 |
| 4 | 300,000 | 1,240,000 | 656,000 |
| 5 to 27 | 275,000 | 7,290,000 | 3,857,000 |

[a] Exploration phase
Source: SPGMR Plan of Operations, Table 3.2-1

During mine development, groundwat expected to be encountered when joints, faults, and shear zones are intersected. Should water-bearing fissures be encountered in the stoping area, the water would be allowed to drain. In development headings or other areas of the mine, each water-bearing fissure would be evaluated when intersected and the decision to seal or grout the inflows would be made depending on the volume and the expected duration of the discharge. Grouting techniques would be used to seal those inflows that require containment. In the case of a drill hole, a packer may be installed. Whenever hydrogeological evidence suggests a need, a probe hole would be drilled ahead of drift advance to check for structural and possible water-bearing zones. Should permanent inflows be encountered, an application to appropriate the source would be filed with the Montana Department of Natural Resources and Conservation (DNRC).

The water from the intersected fissures would be handled in one of two ways. If the water is potable and confined within a drill hole, this water source may be tapped and used to supplement or replace the potable water supply being pumped from the surface to the mine. Alternatively, the water would be allowed to drain into the mine discharge-water handling system. The second source of discharged mine water would be the potable water that has been introduced into the mine for personal use and for ng purposes (e.g., drill water, wet-down water, dust control). This water would ultimately drain from th point of usage into the mine discharge-water handling system.

The final source of mine discharge water is expected to be the decant water from the sand fill silos. The water decanted from the silos would be allowed to enter the mine discharge-water handling system for ultimate disposal.

The mine discharge-water handling system would consist of a series of drainage holes drilled between the mine levels to allow mine water to descend to the East Boulder adit level. Water from the workings would drain to the level below and be routed to the drain holes via a ditch system and supplemental pipeline systems installed on each level. Once the water is on the adit level, it would be ditched and/or piped out the East Boulder adit to the water disposal system. Prior to disposal, a portion of this water could be

utilized as the make-up water source for the sand fill system or for other local uses not requiring a potable source. All water diverted to these alternate uses would ultimately be re-introduced to the basic mine discharge-water handling system after usage.

#### 2.3.6.2 Mine Water Disposal

The mine discharge water would be collected at the East Boulder Mine portal and gravity fed through a buried pipeline to the water disposal system. As a first step in the disposal process, the mine water would be run through a thickener or into a settling pond to remove as much of the sediment load as practical. The sediment would consist of fine rock particles. Periodically, this captured sediment would be removed from the system and deposited in the tailing pond or another suitable disposal site. After sediment removal, the water would enter a percolation pond(s) for introduction into the sub-soils.

SPGMR has also proposed that an unknown portion of the discharge water from the mine would be used around the East Boulder adit site for spray irrigation of ongoing mine reclamation areas and as a possible source of makeup water at other site facilities. Spray evaporation would be used whenever practical as a low volume disposal alternative to the primary water disposal pond(s) system.

The water disposal ponds would be sited to utilize as much of the natural topography as practical. Each pond area would be stripped of soil, and the site area would be graded as required. Dam construction would utilize the earthen material excavated from the ponds, or surplus mine development waste rock.

#### 2.3.6.3 Surface Water Management

Potable water for the project would be provided by groundwater wells or by temporary surface water diversion. The well(s) would be equipped with deep-well submersible pump(s) discharging into a domestic water tank located at the plant site. Distribution of water for fire protection and potable usage would be by pump or emergency back-up systems.

SPGMR has been granted a temporary permit to appropriate water from the East Boulder River for mill make-up water. This permit authorized extraction of 200 gallons per minute from the river with a maximum extracted volume of 50 acre-feet per year (Permit No. 66426-543BJ, April 20, 1988).

SPGMR has been granted a provisional permit to appropriate groundwater to be used in mining and milling activities. This permit authorizes extraction of up to 260 gallons per minute of groundwater, with a maximum extracted volume of 419.37 acre-feet per year (Permit No. 73429-G43BJ, July 10, 1990).

Potable water is expected to be used at one of the following three primary usage points: (1) the mine; (2) the surface sanitary system; and (3) the mill. Water used for surface sanitary purposes would be discharged to a conventional sub-surface sewage treatment/septic system. Potable water would be combined with recycled process water from the tailing pond for use as the mill make-up water source. This combined water stream would ultimately be discharged into the tailing pond along with the fine sand fraction that would be unsuitable for use as a mine backfill product.

Surface water runoff from the facilities would be controlled to minimize erosion and to trap sediments. The yard and facilities complex constructed at the East Boulder adit site would be sloped and graded to discharge surface runoff toward the water disposal pond system. The construction of facilities in the Placer Basin area would include the design provisions to control and impound surface runoff.

#### 2.3.6.4 Project Water Balance

A generalized water balance for the project based on an estimate of the source and demand volumes has been developed by SPGMR. It is expected that water would originate from one of the following three sources: (1) potable well water; (2) mine groundwater; and (3) precipitation on the tailing pond. From these sources, it has been estimated that approximately 850 gpm would require disposal when at steady state operating conditions.

Water disposal methods and sites are expected to be as defined in Figure 2.3-8. These sites and the estimated flow volume to be handled by each are as follows: the sewage drain field (10 gpm); the water-disposal ponds or alternative spray evaporation and irrigation systems (737 gpm); retention in the underground sand fill (9 gpm); and evaporation of tailing water through spray systems (23 gpm), entrainment of water in the tailing impoundment (67 gpm), and evaporation from the concentrate dryer (2 gpm). A surface water discharge permit will be applied for to allow direct discharge to the East Boulder River during contingency conditions, such as a storm event or capture of excess groundwater during mining.

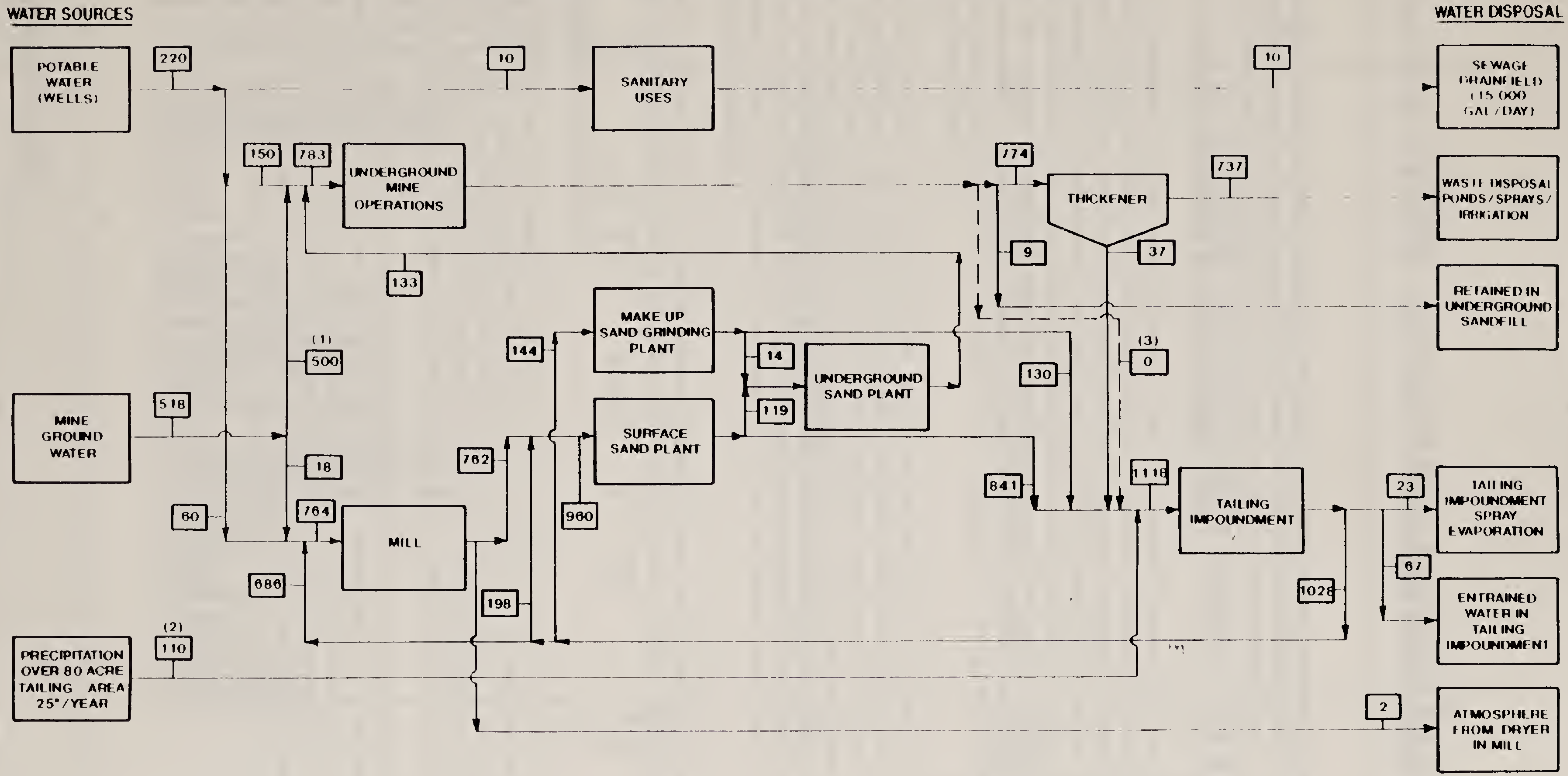
#### 2.3.6.5 Project Water Quality

Water quality estimates for the project have been based on actual East Boulder Mine Project site conditions and water assay data from the Stillwater Mine. Because of the similarities in the projects, the Stillwater data are expected to closely approximate the water quality conditions at the East Boulder Mine Project. East Boulder Mine discharge water would originate from three sources, including (1) water used in the mining process; (2) mine groundwater, primarily from water-bearing fissures; and (3) decant water from the underground sand fill silos.

The quality of the untreated East Boulder Mine discharge water (Table 2.3-6a) has been estimated by SPGMR using December 1989 water sample assay data from specific Stillwater Mine sample points that are expected to approximate the quality of the water attributable to these three sources. Data collected in March 1991 by SPGMR have been used, in conjunction with the data shown on Table 2.3-6a, to evaluate potential impacts of discharge water on the existing quality of surface waters and groundwater. When combined in proportion to their estimated volumes, SPGMR expects the mine discharge water to meet all drinking water standards. The one exception is suspended solids, which are traditionally high in mine discharge waters. At the East Boulder Mine, the mine water would be treated in a thickener or a settling pond to remove the majority of the suspended solids before discharge to the percolation ponds.

Potable water would be provided from surface wells in the East Boulder River Valley. In 1989, a 179-foot, 8-inch-diameter water well was drilled, pump tested, and sampled near the proposed portal site. Approval of appropriate groundwater from this source has been granted by DNRC.

# 730,000 TONS/YEAR STEADY STATE PRODUCTION




NOTE:

(1) MINE GROUND WATER FLOW IS VARIABLE. THE 500 GPM SHOWN IS AN ESTIMATED AVERAGE

(2) BASED ON AN ULTIMATE LINED AREA IN THE TAILING IMPOUNDMENT OF 80 ACRES

(3) MINE WATER FLOW TO THE TAILING IMPOUNDMENT IS EXPECTED TO NORMALLY BE 0 GPM. MINE WATER WOULD BE DIRECTED TO THE IMPOUNDMENT WHEN A RECLAIM WATER SHORTAGE EXISTS DUE TO LOWER PRECIPITATION OR HIGHER RATES OF DISPOSAL

LEGEND

[box] – $H_2O$ GPM

SOURCE
SPGMR OPERATING PLAN

## WATER BALANCE

FIGURE 2.3-8

TABLE 2.3-6a

ESTIMATED MINE DISCHARGE WATER QUALITY BEFORE TREATMENT[a]

| | Drinking Water Standard | Mine Usage[b] | Source: Mine Ground-water[c] | Source: Mine Sand Fill[d] | Total Mine Discharge |
|---|---|---|---|---|---|
| **CONSTITUENT** | | | | | |
| Potassium | | 1 | <1 | 5 | 1.7 |
| Sodium | | 55 | 6 | 120 | 35 |
| Calcium | | 9 | 23 | 183 | 48 |
| Magnesium | | 180 | 8 | 24 | 43 |
| Sulfate | 250 | 11 | 7 | 594 | 108 |
| Chloride | 250 | 11 | <1 | 24 | 6.8 |
| Carbonate | | 0 | 0 | 0 | 0 |
| Bicarbonate | | 127 | 112 | 84 | 110 |
| Total Dissolved Solids @ 180°C | 500 | 430 | 109 | 1100 | 338 |
| Total Hardness as $CaCO_3$ | | 231 | 89 | 555 | 195 |
| Specific Conductance @ 25°C | | 684 | 194 | 1470 | 504 |
| pH | 6.5 - 8.5 | 7.5 | 7.7 | 7.1 | 7.6 |
| Total Suspended Solids | 10 | 6380 | 1170 | 42 | 1968 |
| Fluoride | 2.4 | 0.1 | <0.1 | <0.1 | 0.1 |
| Nitrate plus Nitrite as N | 10 | 14.9 | 0.52 | 35 | 9.1 |
| Total Kjeldahl Nitrogen | | 0.2 | 1.7 | 3.7 | 1.8 |
| Ammonia | | <0.1 | 0.3 | 1.1 | 0.4 |
| Total Phosphorous as P | | <0.01 | <0.01 | 0.45 | 0.1 |
| **DISSOLVED** | | | | | |
| Cadmium | 0.01 | 0.002 | <0.001 | <0.001 | 0.001 |
| Chromium | 0.05 | <0.02 | <0.02 | <0.02 | <0.02 |
| Copper | | <0.01 | <0.01 | <0.01 | <0.01 |
| Lead | 0.05 | <0.01 | <0.01 | <0.01 | <0.01 |
| Nickel | | <0.03 | <0.03 | <0.03 | <0.03 |
| Zinc | 5 | 0.02 | 0.02 | 0.01 | 0.02 |
| **FLOW VOLUME BY SOURCE** | | | | | |
| Estimated Flow Volume (GPM) | | 150 | 500 | 133 | 783 |
| Contribution to Discharge (percent) | | 19 | 64 | 17 | |

[a] All values in mg/l, except where otherwise identified
[b] Based on SMC Source SMC-3, December 1989
[c] Based on SMC Source SMC-9, December 1989
[d] Based on SMC Source SMC-4, December 1989
Source: Stillwater Mining Company 1989.

The tailing water, which would be retained in the lined tailing impoundment and would be recycled for use in the milling process, has been assumed to be similar in quality to the Stillwater tailing water. An assay of the Stillwater tailing water quality is found in Appendix D of the Plan of Operations.

#### 2.3.6.6 Petition for Modification of Quality of Ambient Water

SPGMR submitted a Petition for Modification of Quality of Ambient Water to the Water Quality Bureau on April 15, 1991. The purpose of the petition was to request that a change in water quality limits for groundwater and surface water be made which would allow the mine company's proposed method of mine water discharge to be implemented. As described by SPGMR in the 1991 Petition, "This petition is necessary because the proposed mining and milling operation cannot be designed, constructed, and operated without the occurrence of excess water from precipitation and from inflow of groundwater into the underground mine." The petition was submitted pursuant to ARM 16.20.704, and in response to a letter from the Water Quality Bureau, dated March 4, 1991, regarding the nondegradation provisions of the Montana Water Quality Act.

Percolation from disposal ponds at the East Boulder project would result in changes in the quality of ambient groundwater in the vicinity of the ponds and potentially in the surface water in the East Boulder River. Direct discharge of adit water to the East Boulder River would result in changes in the quality of ambient water in the river. SPGMR has indicated in the Petition (4/15/91) that the requested water quality limits, necessary to allow their proposed method of mine water discharge, would be better than applicable water quality standards but not as good as the existing water quality of the East Boulder River or groundwater. Table 2.3-6b presents the maximum modifications of ambient water quality requested for the proposed water discharges.

SPGMR has indicated that the net impact of the mine discharge water on the quality of surface water would be minimal and that there would be no impacts that restrict present or future beneficial uses (SPGMR 1991).

### 2.3.7 Subsidence and Landslides

A 20- to 50-foot interval of competent rock (crown pillar) would be left in place between the uppermost stopes in the mine and the ground surface to prevent surface subsidence. In addition, these stopes would be backfilled with classified mill tailing (sand fill) and/or other waste material to further enhance the final support of the stope. Furthermore, the dimensions of the mine workings in relation to the geology of the area suggest that even major ground falls in the mine would not result in surface subsidence.

These subsidence conclusions are based on the following factors: (1) actual mining experience at the Stillwater Mine (which includes mining up to and securing the crown pillar), (2) actual mining experience at the Frog Pond adit, and (3) rock mechanics tests conducted on the various rock types at the Stillwater Mine. Since the geologic setting of the deposit between Stillwater and East Boulder Mines is so similar, the results of the rock mechanics tests performed at SMC are expected to be valid for both areas. The results of the rock mechanics testing at the Stillwater Mine are described in the SPGMR Plan of Operations, Section 3.2.4.

Based on the results of the subsidence and landslide analysis testing, SPGMR developed mining mitigation measures to ensure a stabilized crown pillar after operations cessation:

- An adequate minimum crown pillar (20 to 50 feet) would be left above all near-surface stopes. This crown pillar would be determined by underground drilling to locate the rock-overburden interface in advance or during stoping.

- The top of each stope would be routinely rock bolted to prevent pillar spalling.

- Additional stabilizing measures would be used, such as more bolting or matting if deemed necessary.

- All stopes immediately below the crown pillar would be filled with sand fill or other suitable fill medium.

In the event any portion of the crown pillar would subside during or after mining, appropriate mitigation measures would be taken to stabilize the pillar from further collapse. When necessary, temporary measures such as fencing would be undertaken until permanent measures could be implemented.

TABLE 2.3-6b

REQUESTED CHANGE IN WATER QUALITY LIMITS[1]

| Parameter | Surface Water Quality Standard | Requested Surface Water Quality Limit | Groundwater Quality Standard | Requested Groundwater Quality Limit |
|---|---|---|---|---|
| TDS | 250 | 200 | None | |
| Nitrate+Nitrite | 10 | 5 | 10 | 8 |
| Ammonia[2] | 1.18 | 0.4 | None | |
| Chromium[3] | 0.011 | 0.005 | 0.05 | 0.02 |
| Iron | 0.3 | 0.2 | None | |
| Lead[4] | 0.0032 | 0.003 | 0.05 | |
| Manganese | 0.05 | 0.03 | None | |

[1] All values in mg/l. Surface water standards and limits are for total recoverable metals. Groundwater quality standards and limits are for dissolved metals.

[2] Amonia concentrations are based on a pH of 8 and a temperature of 5° C.

[3] Water quality standards are for hexavalent chromium. Requested limits are for total chromium including hexavalent ($Cr^{+6}$) and trivalent ($Cr^{+3}$) chromium.

[4] Lead concnetrations are based on 100 mg/l total hardness.

Source: SPGMR, 1991

### 2.3.8 Energy Consumption and Source

During the exploration phase of the project, from three to four megawatts of power would be required to operate the tunnel boring machine, ventilation system, and support facilities. This power would be supplied by an on-site generator plant. Until a permanent source of power can be constructed at the site, this generator would supply any supplemental power needed during surface facility construction and the start of mine construction and operations. SPGMR has submitted an application for an air quality permit for the exploration phase of the project, which contains estimated emissions concentrations, specifications, operations schedules, etc. The long-term source of power for the project is expected to be provided by Park Electric Cooperative. The estimated electric demand for the project when at full capacity would be approximately eight megawatts. The design load for the system would be in the 12 megawatt range.

Various alternatives for distribution of power by Park Electric have been developed. These are discussed later in Section 2.4.3.

After the permanent power supply has been constructed, the generator plant would be used to provide an emergency power source during times of supply outages. The construction and up-grading of a new regional power supply should provide a reliable long-term power source to the project as well as to the local consumers along the route.

Propane would be used for heating mine air and for building heat. Propane tanks would be installed on surface adjacent to the mine heating system and near the general facilities building.

The DHES Air Quality Bureau has issued a Preliminary Determination on SPGMR's permit application for the project. The Preliminary Determination is included in Appendix C of this document.

### 2.3.9 Roads

Access to two of the three primary areas of planned mining activity would be by existing roads where possible. Specific transportation requirements for the three areas are described next.

#### 2.3.9.1 East Boulder Permit Area

Access to the East Boulder permit area would be via FS 205. A local road system would be constructed at the adit site to service and access the facilities. This road system would include two new primary roads, numerous short local-access spurs, and use of a short segment of FS 6644. One of the new primary roads would provide access to the general facilities building and East Boulder adit. This road would ultimately be located between the toe of the tailing pond and the East Boulder River. The second new primary road would be installed on the hillside above the tailing pond between FS 6644 and the adit yard. This road would be used primarily for tailing pond construction and waste rock haulage to the impoundment embankment.

Project equipment that would use the existing road system from State Highway 298 to the East Boulder Mine site would include: graders, dump trucks, front-end loaders, flat-bed trucks, low-boy transporters, snow plows/blowers, sanding trucks, water trucks, and utility vehicles (pickups, vans, buses, automobiles). The ore concentrate produced by the mill would be transported from the site to an off-site smelter in trucks or

semis. The road width for this segment of road would be improved to a double-lane, 24-foot running surface and would be coated with a minimum of 6 inches of gravel.

All existing roads that would be used for site access would be evaluated, and determinations would be made regarding the suitability and adaptability to project requirements. The cost of all road improvement and rerouting inside the project area would be the responsibility of SPGMR. Evaluations of roads suitability outside the project area (i.e., FS 205, SG 31, etc.) are included in Chapter Four of this EIS.

Various alternatives for road access to the East Boulder adit site have been proposed and evaluated in this document. Section 2.4.2 later in this chapter, describes the alternatives considered and discusses the reasons for elimination of some of those from further consideration. Impacts caused by the alternatives considered in detail are described in Chapter Four, and a comparison of alternatives is presented in Chapter Five.

FS 205 (the Forest Service road currently extending from the northern FS boundary at SG 31 to near the project site) would also require improvements both during exploration and particularly during the production phase of the project. An engineering study would be conducted to identify opportunities for improvement in the areas of visibility, snow removal/maintenance, road width, road surfacing turn-out spacing, etc. The utilization of guard rails or other barriers along those sections of road with hazardous and steep outer side slopes would be evaluated.

From the termination of FS 205, a secured site access road would be constructed to the East Boulder adit facilities. All new construction or improvement would be in compliance with applicable design standards.

**2.3.9.2 Placer Basin Permit Area**

Road access to the project facilities that are proposed for construction in the Placer Basin permit area (also referred to as the East Boulder Plateau) would be from Stillwater County Roads FAS 419 or FAS 420. From either of these roads, FS 140 and FS 142 would be accessed for travel to the Frog Pond adit area.

Helicopters may be used for tasks such as emergency travel, casual site access, crew and equipment deployment, and assessment programs. For facility construction and operation, FS 140 would be the travel route. From FS 140, spur roads would be constructed to access the individual facilities. Wherever necessary, FS 140 would be upgraded and maintained to accommodate the equipment that would be transported into the area. It is anticipated that the use of FS 140 would be minimal and road upgrades from the intersection with FS 142 to the Frog Pond adit area would be required only for the safe and expedient transportation of equipment and personnel to the area.

Once in the area of the proposed Blakely ventilation raise, the 9450 and 9250 adits, and the Frog Pond ventilation raise, shaft, and adit, FS 140 will be upgraded for local operational needs. This would also involve the construction or up-grading of road access spurs to each of the aforementioned facilities.

Access to the West and 8650 adits would be by helicopter only. No surface access roads to these sites are anticipated at this time.

Roads constructed in the Placer Basin permit area would be single lane with turn-outs. These roads would be constructed in compliance with U.S. Forest Service and MSHA requirements.

The travel requirements to the facilities within the Placer Basin permit area are expected to be minimal. The mining facilities that are envisioned would be accessed primarily from the mine workings. The local road system that would be constructed between the facilities would be located on patented mining claims. Any improvements to the access road system would be in accordance with design standards required by GNF.

#### 2.3.9.3 Brownlee Creek Permit Area

Access to the Brownlee Creek adit site would be by helicopter only. No surface access roads to this permit area are anticipated.

### 2.3.10 Ore Handling

All ore would be hauled to surface through the East Boulder adit. The ore would be loaded from the ore passes to rail cars for transportation to surface. Alternatively, a conveyor system may be used for this purpose.

Once outside, the ore would be dumped into an ore bin or a stockpile area (Figure 2.3-2). From the ore bin, the ore would be conveyed to the mill. If the bin is full, an alternate stockpile area would be used for temporary ore storage. From the stockpile, a front-end loader would be used to transfer the ore to the conveyor system. Any ore produced before the start-up of the mill would be stockpiled on the surface near the mill. The most probable location would be within the area that would ultimately be disturbed by the construction of the tailing pond.

At full production, the mine would produce approximately 730,000 tons of ore annually, with a cumulative total production of approximately 18,030,000 tons after 27 years.

### 2.3.11 Surface Equipment

Surface equipment may include road graders, snow plows, sanding and water trucks, fork lifts, cranes, front-end loaders, haul trucks, utility trucks, lube and fuel trucks, dozers, compactors, buses, vans, and pickups. The earth-moving equipment would maintain and improve project roads and transport mine waste to the tailing embankment. Dozers, trucks, loaders, and compactors would be used to construct the dam. Loaders and trucks would be used to transport ore from the stockpile to the mill feed point. The major surface equipment requirements are summarized on Table 2.3-7.

### 2.3.12 Surface Support Facilities

#### 2.3.12.1 Adits, Shafts, and Ventilation Raises

It is anticipated that a total of seven adits, one shaft, and three ventilation raises would be required over the operating life of the mine for development and access. Final location and number would be dependent on actual conditions encountered, accessibility to the sites, changes in technology, scheduling, health and safety requirements, and economic considerations. The locations of the planned facilities are shown on Figures 2.3-3 and defined on Table 2.3-8.

TABLE 2.3-7

UNDERGROUND AND SURFACE EQUIPMENT SUMMARY
(MAJOR ITEMS AT FULL PRODUCTION)

| Underground Equipment | Expected Range |
|---|---|
| LHDS | 15 - 20 |
| Jumbos | 2 - 9 |
| U/G Haul Trucks | 16 - 22 |
| Jacklegs/Stopers | 204 - 270 |
| Locomotives | 4 - 6 |
| Muck Cars | 24 - 32 |
| Flat Cars | 25 - 34 |
| Rail Man Cars | 7 - 10 |
| Personnel Carriers | 10 - 14 |
| Slushers | 77 - 103 |
| Compressors | 8 - 11 |
| U/G Grader | 2 - 3 |
| Raisebore | 1 - 2 |
| TBM | 1 - 2 |
| Main Fans | 2 - 2 |
| Surface Equipment | |
| Vehicles (Pickups) | 17 - 23 |
| Haul Truck | 2 - 3 |
| Busses | 10 |
| Dozer | 1 - 2 |
| Fire Truck | 1 - 1 |
| Ambulance | 1 - 1 |
| Loader | 1 - 2 |
| Compactor | 1 - 1 |
| Surface Grader | 1 - 2 |
| Maintenance Trucks | 4 - 6 |
| Forklifts | 3 - 4 |
| Service Trucks | 3 - 5 |

Source: SPGMR Plan of Operations, Table 3.2-3

TABLE 2.3-8

PROPOSED MINE FACILITY LOCATIONS

| Facility | Elevation (ft) | Description/Purpose |
|---|---|---|
| East Boulder Adit | ±6350 | Main Access adit |
| Brownlee Creek Adit | ±7160 | Second Exit and Ventilation |
| Placer Basin Permit Area | | |
| Frog Pond Adit | 9075 | Existing Frog Pond Adit |
| 9250 Adit | ±9250 | 9250 Level Access |
| 9450 Adit | ±9450 | 9450 Level Access |
| Frog Pond Shaft | ±9225 | Ventilation |
| Blakely Vent Raise | ±9225 | Ventilation |
| Frog Pond Vent Raise | ±9225 | Ventilation |
| East Vent Raise | ±9075 | Ventilation |
| West Adit | ±8250 | Ventilation/Emergency Exit |
| 8650 Adit | ±8650 | Ventilation/Emergency Exit |

Source: SPGMR Plan of Operations, Table 3.2-5

**2.3.12.2 East Boulder Permit Area**

East Boulder Adit

The East Boulder adit would be the principle means of entry and egress from the mine. As a result, the surface area at the portal site would be the location of the primary mine support facilities. Construction at the East Boulder Mine portal site would be on SPGMR mill site claims.

The mine support buildings would be integrated with the general surface facilities at the East Boulder Mine site. It is anticipated that a three-tiered plant layout would be constructed. The East Boulder Mine portal, mill, and other general site facilities would be located at the 6,350-foot elevation. The base of the ore and waste rock storage would be at 6,320 feet while the parking area would be at an elevation of 6,325 feet. These facilities are defined as follows:

General Facilities Building

The current plan is to utilize the single building concept to house the major site facilities. This building would be approximately 60 x 680 feet and would house the mill, the maintenance shops, the warehouse, and the change facility. In addition, space would be allotted for offices, including an office for safety and training, and a lab.

Ore/Waste Bins

Ore and waste rock from the mine would be hauled to the surface in rail cars and dumped at an ore/waste bin facility and ore hopper. Alternatively, a combination rail/conveyor system may be used for this purpose. Ore and waste bins approximately 30 feet in height would be used for temporary rock storage. Ore would be fed to the mill via a conveyor system incorporated into the ore bin facility. Waste rock would be picked up and loaded into trucks for transport to the tailing embankment or the waste rock storage area.

Waste Rock Storage Area(s)

Waste rock storage area(s) would be designated for the storage of surplus waste rock. The preferred site would be in an area designated as a probable borrow source for project sand and gravel. The pile would hold in excess of 150,000 tons. A temporary waste rock storage area has also been designated for interim waste rock storage.

Sand Plant Building

A building approximately 60 x 60 feet would be required to house the surface sand plant facilities required to deliver sand fill from the mill to the underground sand plant. This facility may be included as part of the general facilities building. See Section 2.3.13.1 for a detailed description of the proposed sand fill system.

Compressor/Generator Building

A building approximately 60 x 60 feet would be required to house the mine compressors and emergency back-up generators. This building would originally be erected as part of the exploration phase of the project and be used to house the generator plant and compressors. Ultimately, this facility could be expanded and incorporated into the mine surface plant as the compressor/generator building. Alternatively, these utilities may be relocated to an expanded general facilities building and the original structure used for storage or for the project emergency generator facility.

Temporary Shop/Storage

As part of the facilities that would be constructed during the exploration phase of the project, a building approximately 40 x 60 feet would be erected as a temporary shop. Should this facility still be on site after exploration, it would be retained and used for storage or other purposes.

Electrical Substations

Two main electrical substations would be required. The first would be the primary substation and would receive high voltage power from the incoming transmission line. From this substation, the voltage would be stepped-down for distribution underground and to the second substation located adjacent to the general facilities building.

Water Tanks and Pump House

A minimum of two water tanks would be required. One tank would hold potable water for distribution underground and on surface. The second tank would hold reclaimed water from the tailing pond for use in the mill and sand plant. A pump house would be installed to distribute the water.

Fuel Storage

Tanks would be installed in designated areas for the storage and distribution of fuels. Diesel fuel would be used in the operation of the underground and surface equipment, gasoline for small surface vehicles, and propane for building heat. All fuel tanks would be bermed to contain accidental spills.

Security Building

A security building would be installed at the entrance to restrict access to designated persons only.

Explosives

Areas would be designated for the storage of explosives and primers. The magazines holding these products would be located in compliance with the current American Table of Distances for Storage of Explosives and 30 CFR Part 57.6.

Laydown Yard

A large area would be required adjacent to the portal for the storage of the bulky mine materials that cannot be stored in the warehouse. These items would include timber, pipe, ventilation duct, rock bolts, and drill steel. Other areas around the site could be used for additional storage of low volume supplies.

Sand and Gravel Borrow Pit

Local sources of sand and gravel would be excavated for use as concrete aggregate and underliner material for tailing impoundment construction. The preferred borrow pit location would also be the preferred location for the primary waste rock storage area.

Concrete Plant and Aggregate Storage

A concrete batch plant would be installed on site for facility construction and other future mine requirements.

Soil Storage Area(s)

Currently three areas have been designated for the storage of soil that would be used for site reclamation (Figure 2.3-2). Additional soil storage sites may be needed to facilitate storage and subsequent reclamation.

Sewage Drain Field

A septic tank system and drain field would be used for sanitary disposal. The septic field would be designed for actual site percolation rates and anticipated volumes. It is estimated that an area of approximately 40,000 square feet would be required for the estimated daily volume of 15,000 gallons.

Parking Lot

Based on the assumption that approximately 85 vehicles may be on site at any one time, an area of approximately 1.5 acre would be required for parking.

#### 2.3.12.3 Brownlee Creek Permit Area

The only surface support facilities that are anticipated at the Brownlee Creek site would be the adit, a yard, a shelter, a small generator, and a heli-pad. The adit, approximately 13 feet in diameter, would be used as the mine's exhaust airway and second exit. The tunnel would be driven from the mine to a breakout near the confluence of Brownlee Creek with the East Boulder River. No surface roads or other surface utility connections along the East Boulder River to this site are expected. The adit portal and yard would be located on SPGMR's Tusker 115 lode claim.

Once the tunnel has been completed, a yard and heli-pad would be constructed using mine equipment and fill from the site area. Should additional fill be required, it would be supplied from the mine or excavated from the adjacent talus slope.

After the yard is constructed, a building approximately 60 x 60 feet would be erected. The primary purpose of the building would be to provide shelter for mine personnel in the event of an underground emergency.

#### 2.3.12.4 Placer Basin Permit Area

The surface area in and around SPGMR's patented mining claims would be the site for various mine support facilities within the Placer Basin permit area. Most construction would be centered around the Frog Pond adit area, although two ventilation raises and two ventilation/emergency exit adits would also be required. In summary, five adits, one shaft, and three ventilation raises are expected to be constructed in the Placer Basin permit area. Final locations and required numbers of facilities would ultimately be based on actual mining conditions, changes in technology, scheduling, health and safety requirements, and economic considerations.

At the western end of the permit area, two ventilation and emergency exit adits would be required. The proposed locations of the adits are on patented lode claims within the permit boundary. These facilities have been designated the West and 8650 adits.

Two outlying ventilation raises have also been planned. These raises have been identified as the Blakely and East ventilation raises. Both facilities would be on patented lode claims within the permit boundary.

In the Frog Pond area, three adits, one shaft, and one ventilation raise would be constructed on patented lode claims Bud 2, 3, 4 and Swan 3, 4, 7, 8, 11, 12 and the Swan 9 lode claim. One of the adits would be

the existing Frog Pond adit, while the other two would be new adits constructed for the development of the 9250 and 9450 levels. The proposed shaft and Frog Pond ventilation raise would be located in the immediate area.

The surface facilities associated with the proposed mine development in the Placer Basin permit area would include the following:

Frog Pond Adit

The area disturbed by prior exploration in the Frog Pond area would be re-occupied. A building approximately 40 x 40 feet would be erected for storage and used as a temporary shop facility as well as an emergency shelter when this adit and the adits at 9250 and 9450 are designated as emergency mine exits. The existing yard area would be expanded to include the area of the old percolation ponds which would no longer be required once mine development intersects the original Frog Pond workings and water can drain to the East Boulder adit level. A heli-pad would also be installed. The Frog Pond adit and associated facilities would be located on the Swan 7 patented lode claim.

Frog Pond Shaft

A shaft is expected to be constructed through to surface in the Frog Pond area. The shaft facility would include a shaft collar, a headframe, an enclosure building, and an approximate 40 x 40-foot hoist building. All construction is expected to occur on the Swan 7 patented lode claim.

Frog Pond Ventilation Raise

A ventilation raise is expected to be installed in the Frog Pond area on patented lode claim Swan 7. This raise would be constructed either by raise boring from surface or by conventional raise mining techniques from underground. The choice would depend on need and the length of the connection. When completed, the facility would be fenced.

Frog Pond Waste Rock Dump

Any surplus waste rock that would be produced from the aforementioned Frog Pond area development and the development associated with the 9250 and 9450 adits discussed below would be discarded using the waste dump facility constructed during the exploration phase of the Frog Pond adit. The volume of waste to be discarded in this facility would be minimal. Only the waste rock produced from the initial development of these facilities, not used for local construction, would have to be placed. Once a connection is made between each facility and the mine workings below, the waste rock would be transferred to the East Boulder adit level for transportation to surface. The waste dump is located on patented lode claim Swan 8 and the Swan 9 lode claim.

The Frog Pond waste dump is a steep natural talus slope. The rock placed in the facility would be dumped over the hillside and allowed to co-mingle with the natural talus. The new material plus the material already placed during exploration would be exposed to weathering and would ultimately be similar in color and texture to the pre-mining talus.

9250 Adit

A portal would be constructed near the 9,250 foot elevation. The site would be adjacent to the existing road which accesses the Frog Pond adit site. Construction activities would be located on patented lode claims, primarily Swan 11 and 17. The waste rock from the start of th... would be used for upgrading the road, adit yard construction, other local construction, or would be d... in the Frog Pond waste dump. A small building (approximately 20 x 20 feet) would be erected near t... . Mine materials would be temporarily stored in the area.

Temporary utilities, such as were in place for the Frog Pond exploration, would be used until connections with underground services are completed.

9450 Adit

The 9450 mine level would be accessed by a new adit and portal located near the existing Frog Pond adit road. The waste rock produced from the start of the adit would be used for yard construction, upgrading the road, other local construction, or would be disposed in the Frog Pond waste dump. A small building approximately 20 x 20 feet would be erected near the portal. The yard area would be used for the temporary storage of mine materials. All construction associated with this facility would be on patented lode claims, primarily Bud 3. Construction utilities would consist of temporary facilities, similar to those used during initial Frog Pond exploration.

West Adit and 8650 Adit

The West adit and the 8650 adit would be located on patented lode claims, Bud 57 and Bud 27, respectively. Both adits would be driven from the underground mine workings to suitable surface breakout locations. These adits would be required as mine ventilation passages and emergency exits. The location of the adits would be decided when a detailed surface reconnaissance can be made of the area to confirm the viability of the selected sites. The following criteria were used in locating the current sites: (1) the portal must not be visible from the Main Boulder River valley floor; (2) the outcrop location selected must be stable and meet facility usage requirements; (3) access to the portals would be by helicopter only (no improved roads or surface utility corridors are anticipated); (4) portals must be near existing heli-pads or possible heli-pad sites; and (5) emergency shelter buildings would be installed near the heli-pad sites.

Blakely Vent Raise

The proposed location of the eight-foot-diameter Blakely ventilation raise would be on patented lode claim Bud 17. Access to the site would be via an upgraded existing road that passes within a short distance of the proposed raise. Because of accessibility of the location, it is anticipated that this raise would be bored from surface. If constructed in this manner, local site grading and temporary services would be installed to complete the task. When completed, the facility would be fenced.

East Vent Raise

The eight-foot-diameter East ventilation raise would be located on or near patented lode claim Virginia 24. This site is remote and it is not anticipated that road construction to the site would be likely. Should road

access be required, final approval from GNF of a design and reclamation plan would be required before commencement of construction. Upon completion, the ventilation raise would be fenced.

### 2.3.13 Mine Utilities

#### 2.3.13.1 Sand Fill System

The sand fill used in the cut-and-fill stoping process would be derived from the mill tailing stream and supplemented as required by processing waste rock through a crushing facility. The tailing produced from the milling process would be pumped as a slurry through a series of cyclone classifiers to separate the coarse fraction of the tailing stream that would be suitable for use as a backfill product. This coarse fraction represents approximately 60 percent of the total tailing stream. The undersized fraction would be sent to the tailing pond for disposal. Should there be a backfill deficiency, waste rock would be crushed to supplement any short-fall.

A building approximately 60 x 60 feet would be required to house the surface portion of the sand plant. This facility would contain storage tanks, a pump delivery system, and the supplemental waste crushing system. This building would either be incorporated into the general facilities building or erected as a separate facility.

The sand produced in the mill and/or the supplemental product from the crushing plant would be stored in holding tanks in the sand plant building. From these tanks, the sand would be withdrawn as a slurry and pumped to an underground sand plant located near the end of the East Boulder adit.

The underground sand plant would be designed and operated similarly to the facility installed at the Stillwater Mine. Large vertical storage tanks would be excavated between the 6450 adit level and the level above to provide approximately 3,000 to 4,000 tons of sand storage. The sand fill would be withdrawn from these tanks as a slurry and pumped to the stopes for placement. Cement or other additives would be introduced at this time as required.

Water decanted from the sand silos would be introduced into the mine discharge water system. When the sand is re-pumped from the silos for delivery to the stopes, recycled mine discharge water would be used. This water would consist of: (1) natural water inflows; (2) potable water used in the mining process; and (3) water drained from the sand fill after placement in the stopes.

#### 2.3.13.2 Mine Ventilation

Mine ventilation would be provided by two electrically powered intake fans located in the East Boulder adit. These fans would eventually deliver approximately 300,000 to 400,000 cubic feet per minute of ventilation air to the mine. During winter months, intake air heaters would be used to warm the air.

Intake air would be directed along the East Boulder adit to the mine workings. Once at the reef, the air would be routed through the mine using the ramp system, the levels, special internal ventilation raises, and stope raises as the primary air passages. Air flow along these facilities would be controlled by strategically placed doors and regulators. Initially, the Brownlee Creek adit would be used as the mine second exit and

single exhaust airway. As mine development advances, the planned ventilation raises, shaft, and adits in the Placer Basin permit area would ultimately be installed to supplement the ventilation network.

During the exploration phase of the project and the development period before the completion of a second exit, all ventilation would be directed into the mine via a 48-inch ventilation duct installed in the East Boulder adit. Once the Brownlee Creek adit is completed, this ducting would be salvaged.

**2.3.14 Security and Public Safety**

Security for the mining facilities would vary depending on the site. The security philosophy that has been incorporated into the design promotes public safety, restricts vehicle access to the sites, and allows wildlife to move through the area to the maximum extent practicable.

A security gate house would be located at the main entrance to the East Boulder adit site. From the security building, a fence or natural barrier would be constructed to secure the area and the facilities. This barrier would be placed between the tailing impoundment and FS 6644.

The riparian area adjacent to the East Boulder River would be left in a natural state, and boulders would be used where necessary to prohibit vehicle access. The access road from FS 6644 along the top of the tailing pond would be posted and locked when not in use or during non-working shifts. For added security, a gate may be installed on the East Boulder Mine portal to be used as required.

The Brownlee Creek adit would be accessible by helicopter only. Because of the remote location and the need to access the surface facilities as emergency second exit purposes, the surface buildings would remain open. A gate would be installed on the portal, which would be normally closed and secured. This gate would be opened only from the inside.

The mining facilities in the Placer Basin permit area would require a number of security precautions. A gate would be installed on FS 140 before the intersection with the SPGMR spur road leading to the Blakely ventilation raise on patented lode claim Bud 8. Keys would be issued to those individuals or claimants that would need to drive beyond the gate. All adits in the area would be secured with gates that would be locked when not in service or during non-working shifts. The collar of the Frog Pond shaft would also be secured in a similar manner. The perimeter around the ventilation raises would be posted and secured with an eight foot chain-link fence topped with barbed wire. The portals of the West and 8650 adits would be equipped with gates that would be normally closed and would be opened only from the inside. Any surface buildings at these sites would be for emergency use only and would be unlocked.

During mine construction and operation, additional safety precautions would be in effect when using the Forest Service road system to access the mine facilities. Precautions would be taken in deployment of equipment and in the design and reconstruction of the roads to minimize interference with public usage.

During adit portal construction and surface facility construction, some surface blasting would be required. At these times the area would be cleared and the road secured. Appropriate hazard warning signs would be posted in the area to forewarn the public.

The East Boulder adit site would be fenced as necessary to restrict access to the site. The mining sites in the Placer Basin permit area would be secured with a locked gate across the access road. All portals would be equipped with locking gates for utilization during times of inactivity. All shafts and ventilation raises would be fenced or otherwise secured to prevent entry.

Precautions would be taken in deployment of equipment to minimize interference with public usage. Appropriate hazard warning signs would be posted to forewarn the public of possible hazards and to restrict access. Explosives storage would be in federally approved magazines equipped with double lock systems and located in compliance with the American Table of Distances for Storage of Explosives. Once the mine has been sufficiently developed, the explosives would be moved to a storage facility in the mine. Within-mine storage is safer from a security perspective, and it also helps to maintain storage of the explosives, since shelf life and functional value are optimized when the temperature remains constant.

### 2.3.15 Sewage Disposal

A conventional subsurface sewage treatment system would serve the project. This system would ultimately consist of a septic tank, dosing tank, and drain field. The capacity of the system would be approximately 15,000 gallons per day. All appropriate regulatory approvals would be obtained.

### 2.3.16 Solid Waste

Solid waste from the operation would be hauled off site for disposal in the Sweet Grass County Landfill, or an approved alternate off-site location. All transportation and usage fees would be the responsibility of SPGMR.

Any wastes classified as hazardous would be disposed of in accordance with applicable federal and state laws, rules and regulations.

### 2.3.17 Fire Protection and Emergency Response

The fire protection plan for the project would be in compliance with all local, state, and federal regulations, including MSHA and the U.S. Forest Service. A detailed fire plan is presented in Appendix E of the Plan of Operations. In addition to the plan, the following fire prevention measures would be implemented at the site:

- All vehicles would be equipped with appropriately sized fire extinguishers.
- Fire extinguishers would be strategically placed throughout the operation.
- The surface facilities located at the East Boulder adit site would be protected by sprinkler systems and/or fire hydrants. In the event of a power outage during the time of need, an emergency generator plant or diesel powered pumps would be engaged to insure a steady supply of water to the sprinkler heads and hydrants.

SPGMR has presented an on-site emergency response plan in Appendix H of the Plan of Operations. This plan details actions that should be taken in the event of emergencies such as tailing spills, dam breeches, petroleum products or chemical spills, mill process tank ruptures, mine water spills, surface or mine fires, and human injuries resulting from a variety of circumstances.

**2.3.18 Personnel**

Mine development and surface support facility construction would begin no sooner than June 1992. Initial mill production would follow within one year. As noted earlier, an exploration phase of development will precede construction activities. Exploration is permitted under a decision notice issued by GNF Big Timber Ranger District on January 12, 1988 (See Appendix B).

SPGMR has estimated that full mine production would be reached within approximately five years, although the schedule could be accelerated by as much as two years depending on the ultimate mine development plan that is selected and the deployment of development equipment. The mill, general facilities building, tailing pond starter dam, and all other primary surface facilities would be completed within the first year. During this period an average of 85 temporary construction persons would be employed, not including personnel associated with off-site construction (i.e., road development, power line installation, etc). Operations after the first year would employ approximately 170 persons, with an escalation in workforce each year until steady state mine production is reached in the sixth year, when approximately 600 persons will be employed. Other temporary, construction personnel are likely to be employed periodically throughout the life of the mine for short periods.

During normal production, most ore would be mined on a two shifts-per-day, five days-per-week schedule. Mill and maintenance functions would operate three shifts per day, seven days per week, while mine development would be scheduled three shifts per day, five days per week. Most mine staff and surface operations personnel would be scheduled on a typical day shift basis.

Road access will be required for personnel working at the mine as well as for service distributors and others conducting mine business. Various routes for mine access are evaluated for environmental and socioeconomic impact in Chapter Four of this EIS. All routes would require construction and/or upgrade to be able to withstand the significant traffic and load increases during facilities construction and mine/mill operation. Upgrades could include bridge reconstruction, road development or widening to 29 feet, and modification to reduce some grades and straighten some curves for safety, drainage control, and stabilization of slopes near roads.

SPGMR would provide for bussing of employees to and from the East Boulder mine site. Approximately 80 percent of the work force travelling to the mine would access the site via bus. Bus capacity would be between 40 and 60 passengers. Other details regarding the bussing program have not been developed since they depend largely on criteria and data which are not available until implementation of the project. For example, staging locations would be based primarily upon populations demographics and land availability at the time of implementation. However, it can logically be assumed the primary staging point would be in Big Timber. Additional staging areas could include Livingston or Columbus. Secondary parking and pick up points could include McLeod, Reedpoint, Greycliff, Springdale, etc. SPGMR would limit delivery of supplies and materials to the mine to daylight hours. Exceptions to this policy would only occur during

operational emergencies. SPGMR has estimated traffic requirements for the project, as summarized in Table 2.3-9.

TABLE 2.3-9

TRAFFIC PROJECTIONS (ADT)[a]

| | |
|---|---|
| During Construction: | |
| Trucks & Other Service Traffic | 54 |
| Employee Traffic | 204[b] |
| Total Construction Traffic | 258 |
| During Mine Operations: | |
| Trucks and Other Service Traffic | 54 |
| Bus Traffic[c] | 20 |
| Employee Vehicle Traffic | 96 |
| Total Operations Traffic | 170 |

[a]ADT = Average Daily Traffic (Average daily traffic represents one vehicle trip in one direction. Two ADTs would equal a roundtrip.)
[b] Assumes 255 employees and 2.5 people per vehicle
[c] Assumes 80% of employees bussed, 50 people per bus

### 2.3.19 Environmental Resources Management

#### 2.3.19.1 Noise

SPGMR has indicated that engineering controls would be incorporated into all project designs to minimize noise. Noise generated by mining activity would be largely contained within the underground workings just as noise generated during the milling process would be contained within the mill building. Exceptions to these examples would be activities generating noise from stationary and mobile sources as well as noise from surface-mounted mine ventilation fans, and occasional surface blasting during construction. Mine and mill support vehicles operating throughout the project would be equipped with mufflers and regularly maintained. Other noise sources include the backup alarms on operating equipment required by MSHA and Occupational Safety and Health Administration (OSHA) safety standards.

The extent that fan noise contributes to ambient noise levels would be dependent on such variables as the time of day, temperature, and relative humidity. During development, outside fans would be equipped with mufflers to minimize noise. When room inside the adit becomes available, ventilation fans may be moved inside to reduce the effect of fan noise.

#### 2.3.19.2 Visual

According to the SPGMR Plan of Operations, visual appearance is one of the criteria used in the location of surface facilities including the tailing impoundment and powerline. Where possible, natural foliage and terrain would be used to shield surface disturbances from sight. A reclamation program would stabilize soils and introduce new vegetation not only to reduce visual impact of the tailing impoundment but also to provide increased forage for wildlife and to reduce erosion potential. In addition, SPGMR would use approved engineering and reclamation techniques where practical to minimize visual impacts.

#### 2.3.19.3 Air Resources

Since November 1988, SPGMR has been operating an air monitoring station in the clear cut area of the East Boulder Mine Project site. This station has been monitoring particulates (PM-10), air temperature, wind speed, wind direction, and precipitation. During the summer months, evaporation data were compiled for use in determining the contribution of evaporation to the project water balance.

SPGMR has described the East Boulder Mine Project site air quality as typical of high mountain valleys that experience up- and down-valley winds with moderate fluctuations in wind speed and direction. SPGMR would control dust with water or dust suppressants. A second air monitoring station would be installed south of the East Boulder adit site when exploration, construction, or production begins.

#### 2.3.19.4 Water Resources

The East Boulder Mine Project site is close to the East Boulder River and its confluence with the Dry Fork tributary. Upstream of the mine site, Canyon Creek and Brownlee Creek also contribute to the East Boulder River. Downstream of the mine site, Lewis Gulch and other minor sources contribute on a somewhat seasonal basis, although Lewis Gulch ran through the summer during 1989.

Surface water quality within the East Boulder River valley is generally good and is characteristic of conditions in high mountain drainages. Monitoring of surface waters both above and below the mine site would be done on a quarterly basis and the results submitted to DSL and DHES in an annual water quality report.

Groundwater quality in the project area is also good with low dissolved solids concentrations and moderate nutrient levels. Project groundwater monitoring samples would be taken on a quarterly basis and the results included in the annual water quality report to DSL and the DHES Water Quality Bureau.

#### 2.3.19.5 Environmental Monitoring

SPGMR's environmental monitoring program would closely resemble the monitoring program now in place at the Stillwater Mine. Surface water quality, groundwater quality, air quality, wildlife programs, and reclamation success would be monitored on a frequent basis, and changes in the programs would be made as required.

Surface water and groundwater would be monitored for compliance on a quarterly basis or as required by a MPDES permit. These monitoring efforts would most likely extend well beyond the permit boundaries to maintain up-to-date baseline analysis of the area.

Air quality would be monitored by stations both above and below the areas of activity. This monitoring would include particulates (PM-10), wind speed, wind direction, air temperature, and precipitation. Noise would be monitored as needed.

The reclamation program would be frequently evaluated to ensure that erosion is kept to a minimum and that revegetation is of high quality and quantity in order to provide quality habitat for wildlife.

During the life of the operation, a Best Management Practices (BMP) Plan would be in effect for erosion and sedimentation control. (The BMP Plan will be required to follow requirements established in GNF's Soil and Water Conservation Practices Handbook.) In general, erosion would be controlled through the on-going reclamation and stabilization of surface disturbances by reseeding cover vegetation or adding chemical stabilization agents. Sedimentation control will be provided by berms and/or sediment traps in areas where ongoing construction makes stabilization impractical and the potential for downgradient transportation of sediments exists.

SPGMR has indicated in the Plan of Operations that due diligence will be used in following applicable laws and regulations of the local, state, and federal agencies to ensure that foreseeable situations involving damage to the human and environmental communities are avoided.

**2.3.20 Project Closure and Reclamation**

SPGMR has developed a reclamation plan for the East Boulder Mine Project as described in Chapter 4.0 of the Plan of Operations (SPGMR 1990). This plan is required to fulfill the requirements of the Montana Metal Mine Reclamation Act and rules for an operating plan. The Act provides for adequate post-mining productivity of the land to ensure that the proposed post-mining land use objectives are met. SPGMR has described a primary objective to enhance mule deer and other wildlife habitat. Much of the remainder of this section is taken directly from Chapter 4.0 of the Plan of Operations (SPGMR 1990).

Reclamation efforts would be conducted concurrent with project operations to the extent practical, and would begin as soon as possible after disturbance to prevent surface erosion, enhance the visual quality of the site, and provide forage for wildlife. SPGMR has suggested that the following areas would be reclaimed during construction and operation of the mine:

- Soil stockpiles
- Percolation pond embankments
- Drainage/diversion ditches
- Cut and fill slopes
- Borrow pits

Areas reclaimed during construction and operation of the facility would be monitored as test plots to determine the efficiency of the revegetation techniques. The operational and closure reclamation procedures

would be modified to reflect experience gained during these on-going programs. Final reclamation efforts would begin after cessation of operations, and would be completed within two or three years.

During construction and operations, an on-going program of erosion and sediment control would be in effect. Using BMP and the program described in the Reclamation Plan, SPGMR would provide for sediment and erosion control throughout the life of the project. In general, erosion would be controlled through on-going reclamation and stabilization of surface disturbances through re-seeding of cover vegetation or through the addition of chemical stabilization agents. Sedimentation control would be provided through the use of berms and/or sediment traps in areas where on-going construction makes stabilization impractical and the potential for downgradient transportation of sediments exist.

The following sections describe specific elements of SPGMR's proposed reclamation methodology.

#### 2.3.20.1 Revegetation

Selection of plant species for revegetation of the tailing impoundment surface and all other areas of mine surface disturbance would be based on pre-mine species occurrence, post-operation land use objectives, establishment potential, growth characteristics, soil adaptation, stabilizing qualities, wildlife palatability, commercial availability, and experience gained from reclamation activities at the Stillwater Mine. The majority of the area to be affected by mining activities supports forest, primarily habitat types within the spruce and subalpine fir series. Some of the disturbed area (south of Chrome Mountain) is at high altitude, where growing conditions are harsh and different reclamation techniques are required. Species selection and seed source are of primary importance, and seed used on upper elevation sites should be collected as near to the site to be reclaimed as possible.

SPGMR has proposed to use the grass and forb seed mixtures and shrub and tree species for planting shown on Tables 2.3-10 through 2.3-13 for the high and low elevations, scree slopes, and interim revegetation needs. Planting rates for forbs, shrubs, and trees are for a combination of any or all species listed to account for availability and site variability and to provide operator flexibility. Seed mixtures may be modified due to limited seed species availability or poor seed quality, site differences, poor initial performance, or advances in reclamation technology. Modifications would require the concurrence of appropriate regulatory authorities.

Noxious weeds would be controlled; chemical control of noxious weeds would occur only after approval from regulatory authorities. All seed will meet the requirements of the Federal Seed Act (7 U.S.C., Section 1551-1610, inc.) and state and county seed and noxious weed laws.

Four tree species have been selected for reforestation in lower elevations: Douglas-fir, lodgepole pine, Englemann spruce, and subalpine fir. These species are part of the pre-mine environment and reestablishment would help to meet post-operation land use objectives (see Section 4.11.2, Closure and Reclamation). Assuming a 65 percent survival rate after 15 years of the initial stocking rate of 870 shrub and tree stems per acre, an estimated 565 shrubs and trees would occur per acre of reclaimed area.

TABLE 2.3-10a
LOW ELEVATION REVEGETATION MIXTURE SEEDING RATES (PLS)[a]

| Species | Common Name | Preferred Variety | Pounds/Acre | PLS/Sq.Ft. |
|---|---|---|---|---|
| Grasses: | | | | |
| Agropyron riparium | Streambank wheatgrass | Sodar | 3.0 | 11 |
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 2.0 | 7 |
| Agrostis alba | Redtop | -- | 0.1 | 11 |
| Bromus marginatus | Mountain brome | Bromar | 4.0 | 8 |
| Elymus cinereus | Basin wildrye | Magnar | 2.0 | 6 |
| Festuca ovina | Sheep fescue | Covar | 1.0 | 16 |
| Poa compressa | Canada bluegrass | Reubens | 0.2 | 11 |
| Stipa columbiana[b] | Columbia needlegrass | -- | 2.0 | 7 |
| Forbs:[c] | | | 1.0-2.0 | 20 |
| Achillea millefolium | Yarrow | -- | | |
| Epilobium angustifolium | Fireweed | -- | | |
| Geranium viscosissimum | Sticky geranium | -- | | |
| Linum lewisii | Lewis flax | Appar | | |
| Trifolium hybridum | Alsike clover | -- | | |
| | | Total Seeded | 15.3-16.3 | 97 |

[a] Rates given are for drill seeding; rates would be doubled for broadcast seeding; PLS = Pure Live Seed.
[b] If unavailable, Stipa viridula would be substituted at a rate of 2 pounds plus PLS per acre.
[c] Rates given for forbs are for a combination of any or all species listed depending on availability.

TABLE 2.3-10b
LOW ELEVATION REVEGETATION MIXTURE PLANTING RATES

| Species | Common Name | Preferred Variety | Planting Rate (Stems/Acre) |
|---|---|---|---|
| Shrubs: | | | |
| Berberis repens | Oregon grape | | 35 |
| Juniperus communis | Common juniper | | 50 |
| Physocarpus malveceus | Ninebark | | 50 |
| Rubus idaeus | Raspberry | | 50 |
| Spirea betulifolia | Spirea | | 75 |
| Symphoricarpos albus | Snowberry | | 75 |
| Vaccinium scoparium | Grouse whortleberry | | 100 |
| | | | Total Planted 435 |
| Trees: | | | |
| Abies lasiocarpa | Subalpine fir | | 75 |
| Picea engelmannii | Engelmann spruce | | 50 |
| Pinus contorta | Lodgepole pine | | 160 |
| Pseudotsuga menziesii | Douglas-fir | | 150 |
| | | | Total Planted 435 |

[a] Rates given are for drill seeding; rates would be doubled for broadcast seeding; PLS = Pure Live Seed.
[b] If unavailable, Stipa viridula would be substituted at a rate of 2 pounds PLS per acre.
[c] Rates given for forbs are for a combination of any or all species listed depending on availability.

Source: SPGMR Plan of Operations 1990

TABLE 2.3-11
UPPER ELEVATION REVEGETATION MIXTURE SEEDING RATES (PLS)[a]

| Species | Common Name | Preferred Variety | Pounds/Acre | PLS/Sq.Ft. |
|---|---|---|---|---|
| Grasses: | | | | |
| Agropyron riparium | Streambank wheatgrass | Sodar | 4.0 | 14 |
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 2.0 | 7 |
| Agrostis alba | Redtop | – | 0.1 | 11 |
| Deschampsia caespitosa | Tufted hairgrass | – | 0.3 | 17 |
| Festuca ovina | Sheep fescue | Covar | 1.5 | 23 |
| Poa alpinum[b] | Alpine bluegrass | – | 0.5 | 11 |
| Forbs:[c] | | | 1.0-2.0 | 20 |
| Achillea millefolium | Yarrow | – | | |
| Epilobium angustifolium | Fireweed | – | | |
| Geranium viscosissimum | Sticky geranium | – | | |
| Linum lewisii | Lewis flax | Appar | | |
| Trifolium hybridum | Alsike clover | – | | |
| | | Total Seeded | 9.4-10.4 | 103 |

[a] Rates given are for drill seeding, rates would be doubled for broadcast seeding; PLS = Pure Live Seed.
[b] If unavailable, Poa compressa would be substituted at a rate of 0.2 pounds PLS per acre.
[c] Rates given for forbs are for a combination of any or all species listed depending on availability.

Source: SPGMR Plan of Operations 1990

TABLE 2.3-12
SCREE SLOPE REVEGETATION MIXTURE SEEDING RATES (PLS)[a]

| Species | Common Name | Preferred Variety | Pounds/Acre PLS | /Sq.Ft |
|---|---|---|---|---|
| Grasses: | | | | |
| Agropyron riparium | Streambank wheatgrass | Sodar | 6.0 | 22 |
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 4.0 | 14 |
| Agrostis alba | Redtop | -- | 0.2 | 22 |
| Festuca longifolia | Hard fescue | Durar | 1.5 | 20 |
| Poa compressa | Canada bluegrass | Reubens | 1.0 | 11 |
| Forbs:[b] | | | | |
| Achillea millefolium | Yarrow | -- | 0.1 | 6 |
| Linum lewisii | Lewis flax | Appar | 1.0 | 7 |
| Shrubs: | | | | |
| Juniperus communis | Common juniper | -- | 1.0 | 1 |
| Ribes aureum | Golden currant | -- | 0.5 | 4 |
| Rosa woodsii | Wood's rose | -- | 1.0 | 1 |
| Rubus idaeus | Raspberry | -- | 0.5 | 4 |
| Trees: | | | | |
| Abies lasiocarpa | Subalpine fir | -- | 3.0 | 3 |
| Pinus contorta | Lodgepole pine | -- | 2.0 | 4 |
| Pseudotsuga menziesii | Douglas-fir | -- | 3.0 | 3 |
| | | Total Seeded | 24.8 | 122 |

[a] Rates given are for drill seeding; rates would be doubled for broadcast seeding; PLS = Plus Live Seed.
[b] Rates given for forbs are for a combination of any or all species listed depending on availability.
Source: SPGMR Plan of Operations 1990

TABLE 2.3-13

INTERIM REVEGETATION MIXTURE SEEDING RATES

| Species | Common Name | Variety | Pounds/Acre | PLS[a]/Sq.Ft. |
|---|---|---|---|---|
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 2.00 | 7 |
| Agropyron riparium | Streambank wheatgrass | Sodar | 4.00 | 14 |
| Agrostis alba | Redtop | -- | 0.10 | 11 |
| Dactylis glomerata | Orchard grass | Paiute | 1.00 | 15 |
| Phleum pratense | Timothy | Climax | 0.50 | 15 |
| Poa pratensis | Kentucky bluegrass | -- | 0.25 | 12 |
| Trifolium hybridum | Clover | -- | 1.00 | 16 |
| | | Total Seeded | 8.85 | 90 |

[a] PLS = Pure Live Seed

Source: SPGMR Plan of Operations 1990

Seedbed and Planting Preparation and Methods

Seedbed preparation would be done immediately after grading and soil placement. On slopes of 33 percent or less, the seedbed would be prepared along contour, utilizing a chisel-plow, disc, or harrow to break up large clods. On steeper slopes, or sites too narrow to negotiate equipment, or where organic debris has been respread, the soil surface would be dozer-tracked or left in a roughened condition.

Herbaceous seeding would generally occur as soon after seedbed preparation as possible, and preferably in the spring. Three methods of seeding would be employed: drill, broadcast, and hydroseeding. Drill seeding would be used on slopes less than or equal to 2.5(H):1.0(V), and typically not on rocky surfaces or where organic debris is widespread. Drill seeding would be done along the contour where possible. If drill seeding is used on steeper slopes that cannot be traversed along the contour, a tracked dozer would be used and seeding would be conducted at about a 45° angle to the contour. Drill row spacing would range from 7 to 14 inches.

Broadcast seeding would be conducted on rocky areas, on inaccessible sites, on steep slopes, on areas of widespread organic debris, and on small areas of disturbance. Seed would be broadcast by hand, by cyclone-type bucket spreaders, mechanical seed blower, or hydroseeder. Where possible, broadcast seeded areas would be chained or harrowed to cover seed. Where slopes allow, broadcast seeded areas would be dozer-tracked perpendicular to slope. Hand raking would be used to cover seed on small or inaccessible sites.

About 250 pounds per acre of seed, fertilizer and mulch would be sprayed in one application of hydroseeding. After hydroseeding, an application of cellulose fiber mulch (one ton/acre) and a tackifier would be applied over the seeded area.

Planting ratios, particularly of tree species, vary from pre-mine conditions to reflect commercial value of the species. Recommended planting ratios may vary depending on slope, aspect, and moisture conditions. It is expected that a certain amount of natural regeneration of tree species would also occur on those sites abutting existing stands. The decision to use containerized or bare-root stock would be based on species, site characteristics, growth medium and substrate season of planting, availability, and cost. SPGMR would investigate the possibility of collecting tree and shrub seed on site to produce genotypically similar stock. Stock would be delivered to the site as close to the time of planting as possible. No stock would be handled when the air temperature is below freezing and no plantings would be made when frost is in the soil. Planting would be accomplished using hand tools and power-driven augers or other machines, depending on size and condition of the planting area, type of stock, and equipment availability. Standard Forest Service techniques (Reforestation Handbook Chapter 700) would be used to plant trees. Mulching may be employed to conserve moisture and reduce competition.

The development of mycorrhizae on roots of forest trees is accepted as necessary for good survival and growth, especially in soils low in available nutrient. SPGMR would obtain stock raised in containers where the soil medium has been inoculated with mycorrhizae, if available.

Competition between herbaceous vegetation and trees would be reduced by one or more of the following method:

- Scalping
- Chemicals (if approved)
- Mulching (including but not limited to straw, wood chips, rock, plastic, or paper)
- Selective broadcasting of the herbaceous seed mixture

Fertilization and Mulching

Fertilizer application rates would be based on soil tests and designed to achieve soil macronutrient levels capable of promoting plant growth and productivity. Vegetative characteristics such as vigor, color, growth rate, etc., would be monitored to determine soil fertility.

Mulching would be used for erosion control and soil moisture retention, and to supply supplemental organic material. Mulch application rates will depend on seeding method and slope. Only straw mulches free of noxious weed seed would be used. Straw mulch may be applied at a rate of one ton/acre on drill seeded surfaces and up to two tons/acre on steeper slopes. Mulch would be anchored using a crimper, disc, or dozer track. A tackifier may be applied at the manufacturer's recommended rate on areas that are mulched in the fall and on areas which require prompt stabilization.

Revegetation Monitoring

Revegetation would be evaluated by field reconnaissance during the first season following seeding and planting to determine initial revegetation success. Adjustments to the revegetation program may be made based on field evaluations.

**2.3.20.2 Soil Storage**

Available soil would be stripped from all lands designated for disturbance before mining or construction activities, except at the Brownlee Creek adit site, which contains little or no recoverable soil. Stripped soils would be placed in an area outside of the proposed area of disturbance and protected from erosion (See Figure 2.3-1). The Plan of Operations estimated that 478,160 bank cubic yards of recoverable soil are available in areas to be disturbed within the East Boulder permit area and 9,050 bank cubic yards of soil are available in areas to be disturbed within the Placer Basin permit area. The recent Order 1 soil survey of the East Boulder permit area demonstrated that more soil is available than originally believed due to greater depths of soil development (SPGMR 1990, as amended). This study suggested that in some areas up to 60 inches of soil is suitable for reclamation. The identification of available soil salvage volumes based on the soil survey and disturbance areas indicates approximately 28 inches could be redistributed over all disturbed areas within the East Boulder permit area.

**2.3.20.3 Roads**

Approximately 2.6 miles of new road would be constructed within the permit areas, and portions of an estimated 25 miles of existing road could be upgraded for the proposed mining operations in the East Boulder permit area, depending on the preferred road alternative selection. New roads would use a balanced cut-and-fill construction, where possible, and waste rock or berms. All berms would be constructed

in accordance with MSHA requirements or USFS standards. Roads would be constructed with a nominal width of 22 feet with an additional 5 to 6 feet of berm.

Roads built or upgraded on private lands would be reclaimed if required by the landowner. Roads constructed on public lands that serve no beneficial post-mining use would be ripped, recontoured, and seeded as deemed appropriate by the regulatory authorities. Upgraded sections of road on public lands that would serve a beneficial use after mining would not be reclaimed. Reclamation procedures would include: ripping of compacted surfaces, recontouring, grading of berms, feathering of slopes, and placing soil and fertilizer before seeding.

Water bars and/or shallow trenching would be used to control runoff in problem areas. Follow-up evaluations of reclamation success, including noxious weed control, would be scheduled on a yearly basis until reclamation is released from bond. As necessary, additional work required would be agreed upon by SPGMR, DSL and GNF.

#### 2.3.20.4 Surface Facilities

No surface facility would be left unless it provides a beneficial use and its existence is approved by the regulatory agencies. SPGMR currently plans to remove all surface facilities and structures during final reclamation. Non-hazardous materials of no salvage value such as concrete and asphalt would be buried or covered at the site, or deposited in a approved disposal site. Waste classified as hazardous would be disposed in accordance with applicable federal and state laws, rules, and regulations. Surface railroads, conveyor systems, and service corridors that are the responsibility of SPGMR would be removed upon cessation of operations, unless they may serve a beneficial use and are approved by the regulatory agencies to remain in place.

Upon cessation of mine operations, the drainage ditch and percolation ponds would remain in place to receive continued inflow from the East Boulder adit. Maintenance for the ponds would be the responsibility of SPGMR. Upon expiration of the permit, SPGMR or successor would be responsible for maintenance and reclamation, as necessary. All other ponds would be backfilled and graded to approximate original contours at the end of operations.

Soil would be stripped from areas designated for surface facility placement during construction stages of the project. During both construction and operation, soil would be applied to cut-and-fill slopes and the site revegetated. Stabilized slopes would not be redisturbed by regrading during final reclamation.

Regrading during final reclamation will use bulldozers and front-end loaders, and be limited to providing proper drainage and burying or covering unsalvageable materials when structures are dismantled. The final topography will be contoured for post-mining land use (see Section 4.11.2, Closure and Reclamation). Soil will be spread on the final grades and reclamation seed mixes incorporated into the soil.

#### 2.3.20.5 Mine Workings

At the time of operation closure, if there is no beneficial future use, surface structures at the shaft and ventilation raise sites would be dismantled or destroyed and buried, entries sealed and the area reclaimed. Sealing the shaft and ventilation raises would be accomplished by constructing a bulkhead below the collar

and pouring a reinforced concrete plug. Waste rock would be dumped into the collar and soil placed on the waste rock.

Adits for which there are no beneficial future use would be reclaimed by plugging the portals with waste rock. If a beneficial future use is identified, the adits would be secured with doors of heavy steel mesh anchored to the rock walls. Hinges and hasps would be attached to the doors in such a manner that they could not be removed when the doors were closed and locked. (Updated and/or modified techniques to seal mine openings may be used in lieu of the aforementioned techniques, depending upon approval by the regulatory authorities.)

Portal pads would be pulled back to approximate pre-mining contours where possible and graded, tilled, soiled, and seeded.

#### 2.3.20.6 Mine Drainage

The underground mine workings are expected to continue to produce water after closure. Drainage would exit the mine via the East Boulder adit and enter the water disposal pond system. SPGMR anticipates the quality of this water will be better than that drained during operations since there would not be any underground activity, and in fact should approximate the regional groundwater quality. Drainage would be discharged to the pond system for disposal.

#### 2.3.20.7 Tailing Impoundment

Tailing impoundment reclamation would consist of dewatering, grading, and revegetating of the tailing site. At project closure the impoundment would cover approximately 105 acres (80-acre pond + 25 acres for dam walls) at a final crest elevation of 6,330 feet. (Assumes use of SPGMR-proposed impoundment design; see discussion of alternatives in Section 2.4-1) Approximately 7.9 million cubic yards of tailing would be stored within the impoundment. At final reclamation, approximately 3.6 million cubic yards of waste rock would be placed in the embankment and used to assist in the final stabilization of the reclaimed tailing surface.

Dewatering

Once the tailing volume reaches the maximum storage capacity, free water would be pumped out of the impoundment and spray evaporated to expose the tailing surface. Dewatering of the top few feet of tailing would be accomplished mainly by promoting natural drying and evaporation. Studies of the tailing impoundment at the Stillwater Mine in Nye indicate that the most advantageous method of dewatering the top five to ten feet of tailing would consist of a combination of methods: drainage would be promoted with horizontal drains and trenching, and evaporation would be facilitated by scarifying and/or trenching the tailing surface. Where the tailing surface remains too soft to support construction equipment, excess mine waste rock or subgrade stabilization fabrics combined with waste rock would be employed to bridge these soft areas. New technological developments during the impoundment life may further facilitate tailing dewatering.

SPGMR has evaluated a number of alternative methods for providing an adequate surface to reclaim the tailing impoundment. These are discussed in detail and compared in Chapter 4.0 of the Plan of Operations.

Although additional reclamation techniques will be evaluated during mine operations, SPGMR has suggested a combination of the following processes could be employed for impoundment preparation:

- Wick drains could be placed on the tailing surface when it reaches a level 5 to 10 feet below the ultimate closure elevation. Drains would be placed in a radial pattern from a collection point located at the lowest part of the impoundment to the outer edge of the impoundment. Because tailing will be deposited from the edge of the impoundment, a beach of coarser material will form with a gentle slope toward the lowest part of the impoundment, where the finer materials will accumulate. Drain spacing will therefore be greatest in the coarser materials, which are less difficult to dewater, and closer in the area of finer materials. The sloping tailing surface would facilitate drainage through the wick drains. During reclamation, the drains would collect water from the tailing and convey it to the collection point from where it would be removed by pumping to a spray evaporation system.

- Special trenching equipment could be used to excavate trenches throughout the tailing surface in a radial pattern as described above. Water seeping from the tailing into the trenches would be distributed to low points and pumped out. Trenching would improve surface drainage because it would facilitate rapid removal of runoff from the tailing surface, thereby allowing evaporation to dry the tailing into a surface crust and gradually lower the water table. It would be necessary to retrench the site continuously until the desired desiccation is achieved since it is difficult to maintain a stable trench more than one foot below the existing crust. Small dredges, amphibious draglines, and low ground pressure equipment types are available for trenching in swampy soil conditions.

- A platform for construction equipment could be developed by laying a subgrade stabilization fabric over the tailing and pushing a three-to-four foot thick layer of waste rock onto the fabric. The platform would be constructed from the edges of the impoundment toward the low point.

Should final reclamation of the tailing impoundment result in water production, then a spray evaporation system would be installed for disposition of the water. This system along with normal evaporation would dispose of approximately 50 to 75 gallons per minute. If additional dewatering is necessary to meet reclamation schedules or dispose of excess water in a particularly wet year, then the installation of a water treatment facility would be evaluated to ensure the quality of the effluent would meet the limits set in a MPDES permit. (Further discussion of reclamation needs for meeting Montana nondegradation requirements is included in Section 4.2)

<u>Grading</u>

After the tailing has been sufficiently dewatered to support construction equipment, the surface would be regraded. Tailing would be bulldozed to prevent runoff over the embankment face and to account for differential settling. It is estimated that during the two years following reclamation, settlements of up to two feet could occur near the center of the impoundment where the tailing depth is greatest; smaller settlements would occur toward the edges of the impoundment. Additional settlements of up to three inches would be anticipated during the next three years. Regrading would result in some compaction; however, final contouring would take into account expected settlement so that depressions would not occur.

Grading would be conducted so that a minimum one percent slope (post-settlement) away from the embankment would be achieved. Surface drainage from the impoundment would be collected by the perimeter drainage ditch and would flow around the ends of the impoundment into natural channels.

In areas of the impoundment where the tailing is difficult to dewater, the tailing could be covered with mine waste rock. The tailing would have a low load-bearing capacity, and it may be necessary to provide subgrade reinforcement, typically consisting of a subgrade stabilization fabric, which would prevent load-bearing failure caused by the weight of the mine waste rock and construction equipment. The fabric would also act as a filter between the two materials to prevent the tailing from migrating into the mine waste rock. If a stabilization fabric is not used, a synthetic filter fabric or layer of sand/sandy soil may be necessary to act as a tailing trap.

#### 2.3.20.8 Soil Handling

Excavation for the tailing impoundment, mill site, percolation pond area, and associated facilities would provide an estimated 478,160 bank cubic yards of soil, which would be stockpiled for later use in reclamation. The soil storage piles would have maximum side slopes of 2(H):1(V), and a minimum surface slope of 2 percent to promote surface drainage.

Soil salvage difficulties due to large rock masses may affect the salvage of estimated soil volumes. However, estimates of soil available for salvage indicate that an average distribution depth of approximately 28 inches on the tailing impoundment surface is available. Tailing and waste rock would also be evaluated for use as a soil or soil substitute. SMC has conducted leachability tests on waste rock, mill waste, tailing, and other process streams which should be representative of materials at the East Boulder Mine Project site (See Tables 2.3-14 and 2.3-15). SPGMR concludes that the results of these tests indicate no phytotoxic characteristics.

The limiting factor for direct revegetation of an embankment composed of waste rock would be low moisture holding capacity resulting from a lack of fines. Tunnel Boring Machine (TBM)-generated waste rock may provide a more suitable medium for revegetation. TBM waste would be evaluated for revegetation suitability by conducting physical and chemical analyses and by on-site revegetation tests. Conventional waste rock and waste rock-TBM mixes would also be evaluated by analysis of revegetation trial plots.

Embankment reclamation would be evaluated by adding TBM waste and/or tailing to conventional waste rock to increase the percentage of fines. If waste rock alone, or waste rock plus TBM waste and/or tailing provides adequate revegetation, stockpiled soil would be used on the impoundment surface rather than the embankment. Embankment reclamation has not been proposed by SPGMR in the Plan of Operations.

#### 2.3.20.9 Dust Control

During operations, wind-blown tailing would be controlled by keeping the tailing saturated and preventing beach development. Soil stockpiles would be stabilized by revegetation. The embankment would be composed of compacted waste rock and should not be a major source of dust. If dust is a problem from the use of TBM waste, it will be controlled by covering with a coarser waste, revegetating, wetting, or using a chemical binder.

## TABLE 2.3-14

## CHEMICAL ANALYSIS OF SMC MINE WASTE ROCK LEACHATE[a]

| Rock Type | Wgt (gms) | Vol (mls) | Final pH | .5N HAC[b] (mls) | mg/l | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | As | Ba | Cd | Cr | Pb | Hg | Se | Ag | Ni | Cu | Fe | Mn | Zn |
| Gabbro | 100 | 2000 | 5.0 | 58 | <.005 | <.1 | <.001 | <.005 | 0.02 | <.005 | <.005 | <.005 | 0.11 | 0.11 | 7.4 | 0.86 | 0.10 |
| Norite | 100 | 20009 | 5.0 | 15 | <.005 | <.1 | <.001 | <.005 | <.01 | <.005 | <.005 | <.005 | 0.09 | 0.11 | 7.8 | 0.41 | 0.05 |
| Anorthosite | 100 | 2000 | 5.0 | 19 | <.005 | <.1 | <.001 | <.005 | <.01 | <.005 | <.005 | <.005 | 0.22 | 0.18 | 19.0 | 0.40 | 0.06 |
| Diabase Dike | 100 | 2000 | 5.0 | 31 | <.005 | 0.1 | <.001 | <.005 | 0.01 | <.005 | <.005 | <.005 | 0.38 | 0.39 | 44.0 | 0.91 | 0.07 |

[a] Waste rock from the Minneapolis adit was analyzed by Anaconda Minerals Company to determine its suitability for utilization as a base for a reclamation soil cap. Representative samples of four different waste rock types were crushed to pass a 3/8-inch sieve. Each sample was then blended and a 100-gram portion was leached with acetic acid at pH 5.0 for a 24-hour period. SPGMR believes that since this test would present the "worst case" conditions for metals to be present in leachate, there is no indication that the waste rock would detrimentally affect reclamation efforts.

[b] Acetic acid

Source: SPGMR Plan of Operations
As - Arsenic
Ba - Barium
Cd - Cadmium
Cr - Chromium
Pb - Lead
Hg - Mercury
Se - Selenium
Ag - Silver
Ni - Nickel
Cu - Copper
Fe - Iron
Mn - Manganese
Zn - Zinc

TABLE 2.3-15

METAL ANALYSES OF SMC MINE WASTE AND TAILING
(EP TOXICITY TEST - EPA 600/4-79-020)
(ALL VOLUMES IN MILLIGRAMS PER LITER)[a]

| Sample I.D. | Mill Feed | Mine Waste | Final Tails | Concentrate | Contaminants[b] |
|---|---|---|---|---|---|
| Lab No. | 16178 | 16179 | 16180 | 16181 | |
| Date Received | 2/12/88 | 2/12/88 | 2/12/88 | 2/12/88 | |
| Arsenic | <0.010 | <0.010 | <0.010 | <0.010 | 5.0 |
| Barium | < 10.0 | < 10.0 | < 10.0 | < 10.0 | 100.0 |
| Cadmium | <0.10 | <0.10 | <0.10 | <0.01 | 1.0 |
| Chromium | <0.10 | <0.10 | <0.10 | <0.10 | 5.0 |
| Lead | <0.50 | <0.50 | <0.50 | <0.50 | 5.0 |
| Mercury | <0.001 | <0.001 | <0.001 | <0.001 | 0.2 |
| Selenium | <0.010 | <0.010 | <0.010 | <0.010 | 1.0 |
| Silver | <0.10 | <0.10 | <0.10 | <0.10 | 5.0 |
| Copper | <0.10 | <0.10 | <0.10 | 0.22 | --- |
| Zinc | <0.10 | <0.10 | <0.10 | <0.10 | --- |

[a] One milligram per liter assumed equal to one part per million

[b] "Contaminants" refers to characterization of the waste as "hazardous" according to Environmental Protection Agency classifications. It should be noted that the toxicity characteristic leaching procedure method of leachate testing has not been applied to these materials.

Source: SPGMR Plan of Operations

Final revegetation would mitigate any post-operation dust. A rock mulch, sprinkling, or a chemical binder would be used to control dust while tailing are being dewatered before final revegetation.

## 2.4 MODIFICATIONS TO THE PROPOSED ACTION - ALTERNATIVES 3, 4, 5 AND 6

This section describes alternatives that have been developed in response to environmental concerns regarding SPGMR's proposed Plan of Operations. All of the alternatives considered for transportation requirements, power line siting, and tailing dam design are briefly described. An explanation is provided for those alternatives that are not carried forward for detailed analysis. A detailed comparison of alternatives is contained in Chapter Five.

### 2.4.1 Alternative 3 - Tailing Impoundment Configuration

Concern over the tailing impoundment configuration has centered on primarily three issues: (1) Stability - public comment questioned whether the proposed tailing dam and pond would be stable during a large earthquake; (2) Visual impacts - some concern has been expressed over the aesthetic disruption to the surrounding area; this concern seems to be regarding the talus-like nature of the reclaimed dam and impoundment; and (3) Reclaimability - finally, some people have questioned whether a dam with a steep face such as the one proposed by SPGMR in the Plan of Operations can properly be reclaimed. In response to these concerns, DSL and GNF developed an alternative tailing impoundment configuration for the EIS.

A description of the tailing impoundment configuration, as proposed in the Plan of Operations, is contained in Section 2.3.4 of this Chapter. It includes impoundment dimensions, liner type and preparation, foundation, dam stability and hydrology of the unit. A summary of the impoundment description is presented below. It should be noted that the impoundment proposed by SPGMR is conceptual in nature. Detailed design specifications have not been submitted with the Plan of Operations.

#### 2.4.1.1 Summary of Tailing Impoundment - Proposed Action

The proposed tailing impoundment would be designed to store the fine fraction of the mill tailing not suitable for use as a mine backfill product. These fines amount to approximately 40 percent of the total tailing volume. The annual tailing storage requirement would range from approximately 60,000 to 292,000 dry tons per year. Approximately 7.6 million cubic yards of tailing would be stored during the estimated 27-year operating life.

Upon completion, the dam would occupy an area of approximately 105 acres with a final crest elevation of 6,320 feet and a maximum height of 140 feet. The embankment crest width for all stages would be 30 feet, and the downstream (outer) embankment slope would be 1.6 (H) to 1.0 (V). The dam would be rock armored to help prevent erosion and slope failure. Characteristics of the proposed tailing impoundment are presented on Table 2.3-3.

#### 2.4.1.2 Alternative 3 - Modified Tailing Impoundment Configuration

In response to concerns over the proposed tailing impoundment, the agencies evaluated a tailing impoundment configuration modified from that presented by SPGMR in the Plan of Operations. The major modification is a change in the outside embankment from a 1.6(H):1(V) to 2.0(H): 1(V); in other words,

the outside slope of the embankment would be less steep in the modification although it would still have rock armoring for slope stability (see Figure 2.4-1 for comparison of Proposed Impoundment vs. Alternative 3). By reducing the outside dam slope and maintaining the original impoundment crest evaluation of 6,320 feet, a loss of approximately 672,000 $yd^3$ in storage capacity results. To compensate for the storage loss, the agencies studied the possibility of raising the final impoundment elevation. An additional 5-foot gain in elevation (final crest 6,325 feet) would create additional storage capacity of approximately 600,000 $yd^3$; however, because the dam toe is fixed, approximately 517,000 $yd^3$ of additional embankment fill would be required to achieve the 5-foot elevation gain. Therefore, the net gain in storage capacity would only be 83,000 $yd^3$. Because of the relatively small effective gain by raising the impoundment height above the originally proposed elevation and having the toe of the slope fixed in location, the only modification presented in this alternative is to the outside dam slope. The height of the dam in the alternative is not altered.

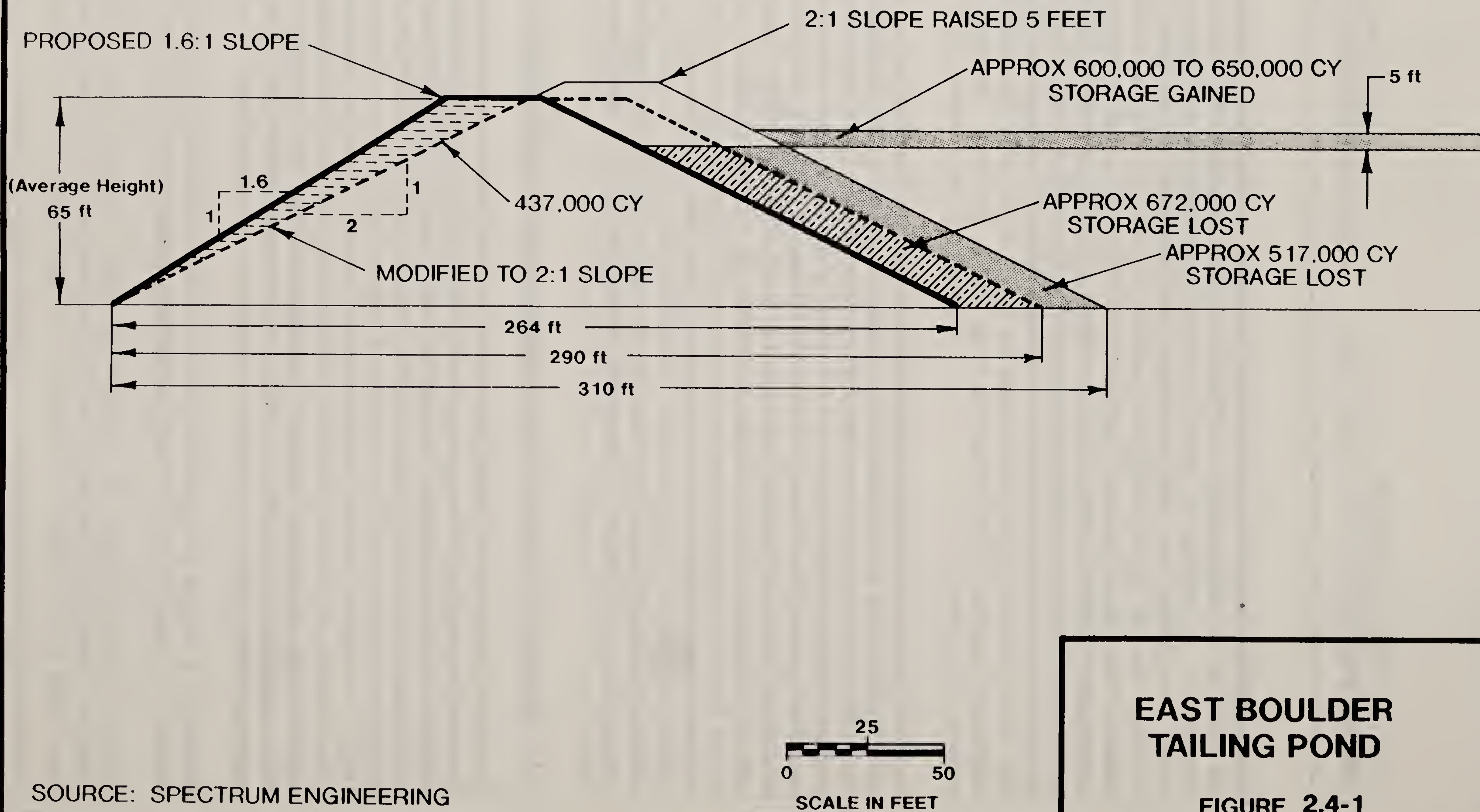
The stability of the new impoundment configuration was computed using the same method and factors used by IECO in its January 1990 preliminary engineering report to SPGMR. By changing the downstream slope from 1.6(H):1(V) to 2:(H)1(V), the Modified Bishop factor of safety increases from 1.7 to 1.9. [The Bishop safety factor can be described as a ratio of forces holding the dam in place over the forces acting to cause dam failure - a factor greater than 1.0 indicates the modeled stability forces are greater than the predicted failure forces.] In other words, the alternative tailing impoundment configuration would increase safety (stability) by 12 percent relative to the proposed action. The loss in impoundment capacity means that the effective life of the impoundment (the time required to fill the impoundment based on SPGMR's estimated filling rates) would be shortened by approximately 2.5 years, from 27 to 24.5 years.

Additional discussion of the potential environmental impacts caused by the proposed tailing impoundment configuration and Alternative 3, the modified tailing impoundment configuration, is contained in Chapter Four.

#### 2.4.1.3 Alternative 3A - Modified Tailing Impoundment Configuration, 3(H):1(V)

The agencies also considered a tailing impoundment bounded by a dam constructed on a 3(H):1(V) slope. The reason this configuration was contemplated is that a 3(H):1(V) slope is considered to be completely reclaimable under most conditions. This slope also would naturally be expected to have an increased factor of stability relative to the 2(H):1(V) and 1.6(H):1(V) slopes, although each of those configurations exceed the minimum stability criteria (U.S. Army Corp of Engineers 1982). However, further consideration of the 3(H):1(V) configuration revealed that approximately 40 percent of the original impoundment capacity would be lost due to the encroachment of the dam into the facility (Solid, 1990). This magnitude of capacity loss would necessitate development of another tailing impoundment. However, no area in the vicinity of the mine is considered acceptable from an engineering or environmental perspective because of the distance needed to transport tailing, poor topography, and necessary stream crossings.

Alternatively, if no area is acceptable for another tailing impoundment, the capacity loss would mean a reduction in the mine life by approximately 40 percent or 10 years.




SOURCE: SPECTRUM ENGINEERING

**EAST BOULDER TAILING POND**

FIGURE 2.4-1

Because the 3(H):1(V) configuration would reduce the tailing impoundment capacity to such a large extent, and because the 2(H):1(V) and 1.6(H):1(V) slope configurations are considered reclaimable and geotechnically stable, this alternative has not been carried forward for detailed analysis.

#### 2.4.1.4 <u>Alternate Tailing Impoundment Locations</u>

Two alternate tailing disposal sites were considered but were dropped because of feasibility, location, and environmental concerns. The Dry Fork site, located upstream from the proposed site, was dropped from consideration because of wildlife and groundwater concerns. The possibility of slurrying tailing into the Elk Creek drainage was dropped because of engineering and environmental concerns.

### 2.4.2 Alternative 4 - Alternative Access Road/Power Line Alignments

SPGMR correctly identified mine access as being a probable social and environmental concern for this project. SPGMR commissioned a report evaluating mine access that presented alternative routes (See SG 31 Road and Bridge Report, Appendix G to the Plan of Operations). Also, other alternatives for mine access were developed by DSL and GNF during project reviews, and by citizens and/or public interest groups during the project scoping process. Each of these alternatives are briefly described in the following sections.

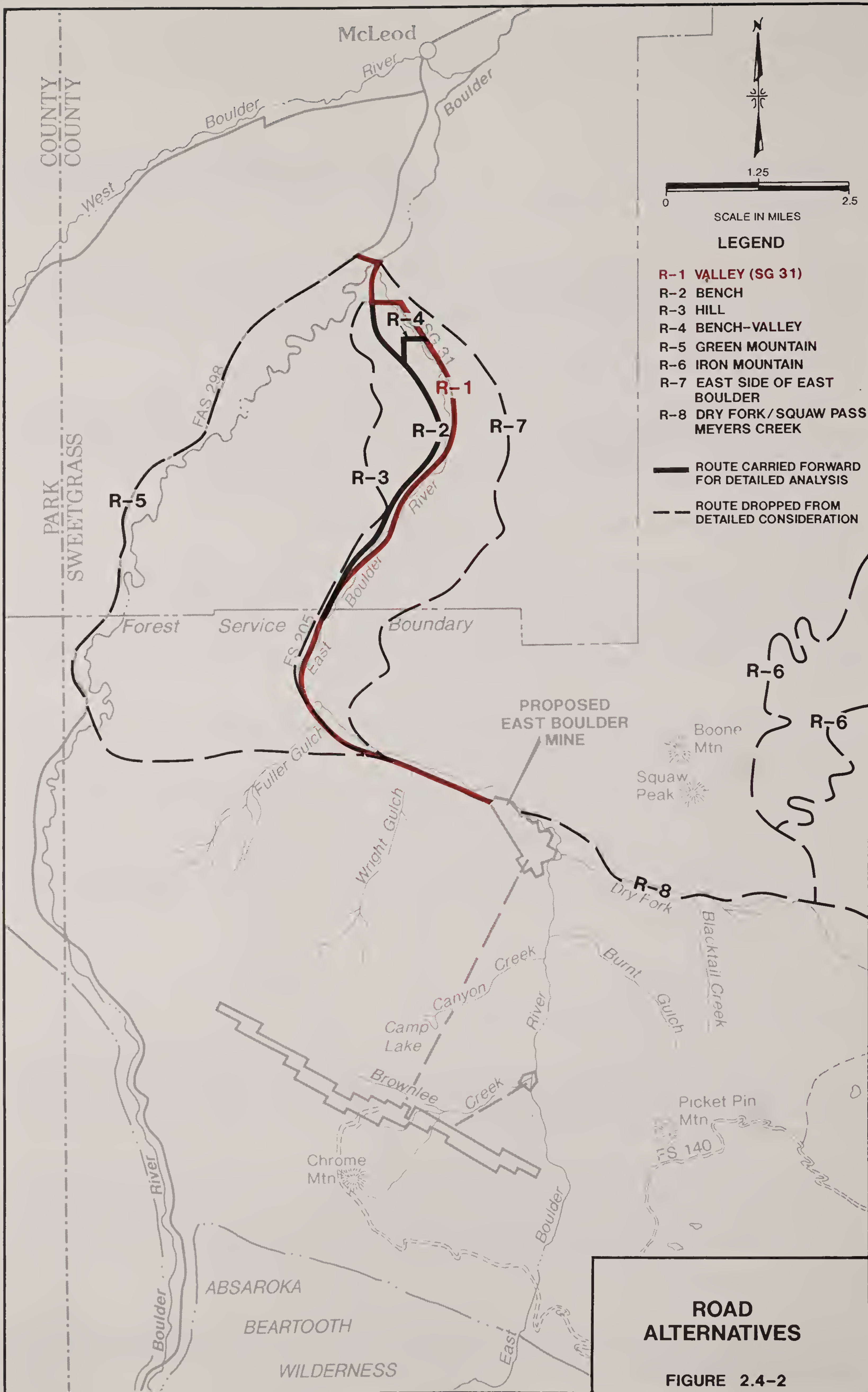
Section 2.4.2.1 describes and discusses road alternatives that DSL and GNF believe to be worthy of more detailed consideration in the EIS, including a summary of the proposed access route. In other words, they provide alternative environmental and/or socioeconomic benefits that may justify their selection as a preferred access route to the mine project. Section 2.4.2.2 describes other road alternatives that the agencies do not believe should be fully evaluated, typically because of a number of obviously detrimental environmental impacts. Justification for not carrying an alternative forward for detailed analysis is presented. Figure 2.4-2 illustrates the approximate routes for each proposed road alternative. Also, it is possible that power lines to the permit area would follow the road access corridor. Therefore, the alternatives presented in this section are meant to be evaluated in conjunction with the transmission line discussions in Section 2.4.3.1, Power Segment #1.

#### 2.4.2.1 <u>Viable Road Alternatives</u>

<u>Proposed Action - Valley or Existing Route (R1)</u>

This route is currently defined by SG 31, the only public road through the East Boulder River valley that extends all the way from state highway FAS 298 to the Forest Service boundary, where it connects to FS 205. It is the existing road for the valley and is identified in the SPGMR reports as the Valley Route or Existing Route or Present Traveled Way (Figure 2.4-2).

SPGMR determined that the existing route has many design deficiencies such as frequent road approaches, steep embankment slopes, and insufficient sight distance. However, it is SPGMR's belief that these deficiencies can be corrected through appropriate road restructuring, slope gradation and stabilization, curve widening, and other safety engineering practices to establish a safe and efficient road. Therefore, it is considered the proposed route by SPGMR.




**ROAD ALTERNATIVES**

FIGURE 2.4-2

The greatest deficiency noted for this route is the potential impact its use for mine traffic would have on the residents living near the road in the valley. Numerous comments have been voiced to the DSL and GNF concerning road noise, dust, maintenance, and safety problems, among other concerns. This road corridor is evaluated in detail for environmental impacts in Chapter Four and compared to other road alternatives in Chapter Five.

Alternative 4A - Bench Route (R2)

SPGMR developed another alternative based on discussions with some individual property owners in the East Boulder River valley. The Bench Route is located on private land as close as possible, given all safety and engineering considerations, to the easterly edge of the "bench" above the west side of the East Boulder River. The bench is approximately 60 to 80 feet in elevation above the river bottom. To develop this route, a climb and descent, respectively, would have to be made on the north and south ends of the river valley before reaching the GNF boundary. Irrigated crop land would be crossed for some of the route, and the Mason Ditch, which irrigates most of the land on the west side of the valley within this study area, would have to be crossed as well. This alternative is evaluated for environmental impacts in Chapter Four and compared to other alternatives in Chapter Five.

Alternative 4B - Bench/Valley Route (R4)

This alternative consists of a combination of the existing route of SG 31 (R1) and the Bench Route (R2). Traffic would route from the SG 31 - FAS 298 interchange along SG 31 approximately 2.5 miles to a location near the existing Boe Bridge. A new bridge would be constructed to handle traffic requirements and routing would then continue via 3/4 mile crossover west to the Bench Route, which would be followed until the Forest Service boundary is reached. This alternative is evaluated for environmental impacts in Chapter Four and compared to other road alternatives in Chapter Five.

#### 2.4.2.2 Road Alternatives Dismissed from Further Consideration

Hill or Ditch Route (R3)

The Hill Route would also be located on private land on the west side of the river, but further west than the Bench Route. The route would be on higher terrain and approximately half of its distance would traverse hay fields. This route would also require crossing the Mason Ditch. Some road grades would be in excess of 6 percent, according to SPGMR. Because of the obvious impacts on agricultural lands, the difficult construction requirements to accommodate the undulating topography, visual impacts, dewatering problems, and the relatively severe slopes of some sections, this alternative has been dropped from further consideration.

Green Mountain Route (R5)

SPGMR also evaluated two variations on a route to the proposed mine area that would be mostly outside the East Boulder River valley on public and private land. The basic path, known as the Green Mountain Route, extends east from FAS 298 in the Main Boulder River valley to approximately the Main Boulder Ranger Station. From there the route would extend either northeast around the northern edge of Green

Mountain and turn southeast to hook up with FS 205, or easterly along the north face of Teepee Mountain and the south flank of Green Mountain to approximately the East Boulder adit location.

Various citizens also recommended a variation on the Green Mountain Route, which would begin in the vicinity of the Natural Bridge and Falls on the Main Boulder River Road.

DSL and GNF gave the Green Mountain alternative and variations serious consideration. However, there are very serious deficiencies associated with any of these routes that preclude the main route from even being considered for a detailed evaluation. The most difficult problem with this route is one of safety considerations. SPGMR suggested in the SG 31 - Road and Bridge Report that a maximum gradient of 8 percent should be used in road designs in mountainous terrain. To achieve this goal for the Green Mountain route, several switchbacks would be necessary, geotechnical engineering would be difficult, and problems with erosion would be likely due to unstable soils.

The eventual road length would likely be longer than any of the other routes considered. The road would climb to a relatively high elevation (approximately 7,000 feet) making winter maintenance difficult and likely impossible during some storm events. Visual impacts of a new road crossing the divide between the Main and East Boulder River valleys could be great, and the route would cross wetlands and favorable wildlife habitat.

Because of the obvious environmental, social, design, construction, and maintenance problems associated with this alternative, it has been dropped from further consideration.

<u>Iron Mountain Route (R6)</u>

This route, located on public and private land, was proposed by citizen comment during the public scoping process. Although not well defined in the proposal letter, the basic route of the Iron Mountain alternative is as follows.

Iron Mountain Road (FS 482) would be accessed at its junction with the I-90 frontage road approximately 7 miles southeast of Big Timber. From there the road travels south-southwest between Upper and Lower Deer Creeks. The road would be built along Lower Deer Creek, then over the divide between Lower Creek and the Dry Fork. The route would then turn due west and follow the Dry Fork to the project location.

Numerous difficulties are presented by this alternative. First, the path described would result in approximately 15 or more miles of new road construction over very difficult terrain. Steep grades would be required and numerous switchbacks likely. Top elevation of this route could extend higher than 8,500 feet, making it very difficult if not impossible to maintain during the heavy winter season in this area. Minimum safety considerations would be difficult to achieve. Environmental impacts could be significant in this high alpine terrain.

Because of the obvious design, construction, environmental, and safety problems inherent in this alternative, it has been dropped from further consideration.

East Side of East Boulder (R7)

During project scoping, an attempt was made to find a road route extending along the east side of the East Boulder River valley which would have less impact on the residents and the river. The route considered would rise above the river valley somewhere just south of the FAS298 - SG31 interchange and level onto the alluvial terraces east of the river. However, it was quickly recognized that this route would cross and impact private agricultural property. In addition, the terrain is very undulating in this area and construction would be difficult. Problems would be encountered especially with erosion, bank or sidewall slumping, and dewatering.

Because of the engineering and erosional problems associated with this alternative, and because it provides no obvious benefits over other alternatives other than its removal from the river valley, it has not been carried forward for detailed evaluation.

Dry Fork/Squaw Pass/Meyers Creek (R8)

This alternative was also suggested during the scoping process. It is the most radical concept suggested because persons accessing the mine would likely not initiate their route in Big Timber, but rather in Columbus, Montana, or some other location on the east side of the Stillwater Complex. This route would be on public land.

The route from Columbus would extend southwest along Highway 78 to Absarokee, where County Road 420 would be picked up going west or just south of Absarokee, where County Road 419 would be accessed also traveling in a westerly direction. County Road 142 would be taken west from Nye for approximately 5 miles, and then north for approximately 2 miles until the intersection with Meyers Creek. Meyers Creek would be followed west over Squaw Pass and down into the East Boulder River drainage via the Dry Fork.

Some of the problems associated with this alternative are the same as for the Iron Mountain Route. High alpine terrain would have to be crossed in an area where winter snowfall could preclude road maintenance. However, other considerations make this alternative unworthy of further consideration, namely its detrimental social and economic impact on Sweet Grass County relative to the other alternatives. Also, it could have serious social and environmental impacts on residents living along the route on the east side of the divide such as increased traffic, noise, and dust.

Because of the social, economic, and environmental problems presented by implementation of this alternative, it has not been carried forward for detailed consideration. Alternatives R5, R6, R7, and R8 do not preclude people from using SG 31, which would be quicker, safer, and more convenient.

### 2.4.3 Alternative 5 - Power Supply Corridor Systems

Power for the project would be supplied by the Park Electric Cooperative. SPGMR has estimated that the electric demand for the project at full capacity would be eight (8) megawatts, while the proposed design load for the energy transmission system would be twelve (12) megawatts. Overall, the service provided by Park Electric would consist of three segments of 69-kilovolt (kV) transmission line. Park Electric has determined

that a minimum of 69 kV is required to maintain adequate voltage in the East Boulder River area and to leave capacity for future growth of existing Park Electric facilities.

It should be noted that while Park Electric identified some preferred alternatives in their Power Supply Study (Appendix C of Plan of Operations), SPGMR did not select specific preferred routes as part of the mine proposal. Because these alternatives are on private land, limited baseline data for segments of the transmission corridor, and some uncertainty over its exact placement of Segment 1, exist (see below). Further discussion of this issue is presented in the Summary and Chapter Four. Figure 2.4-3 illustrates the approximate position of the alternative power routes considered in this document.

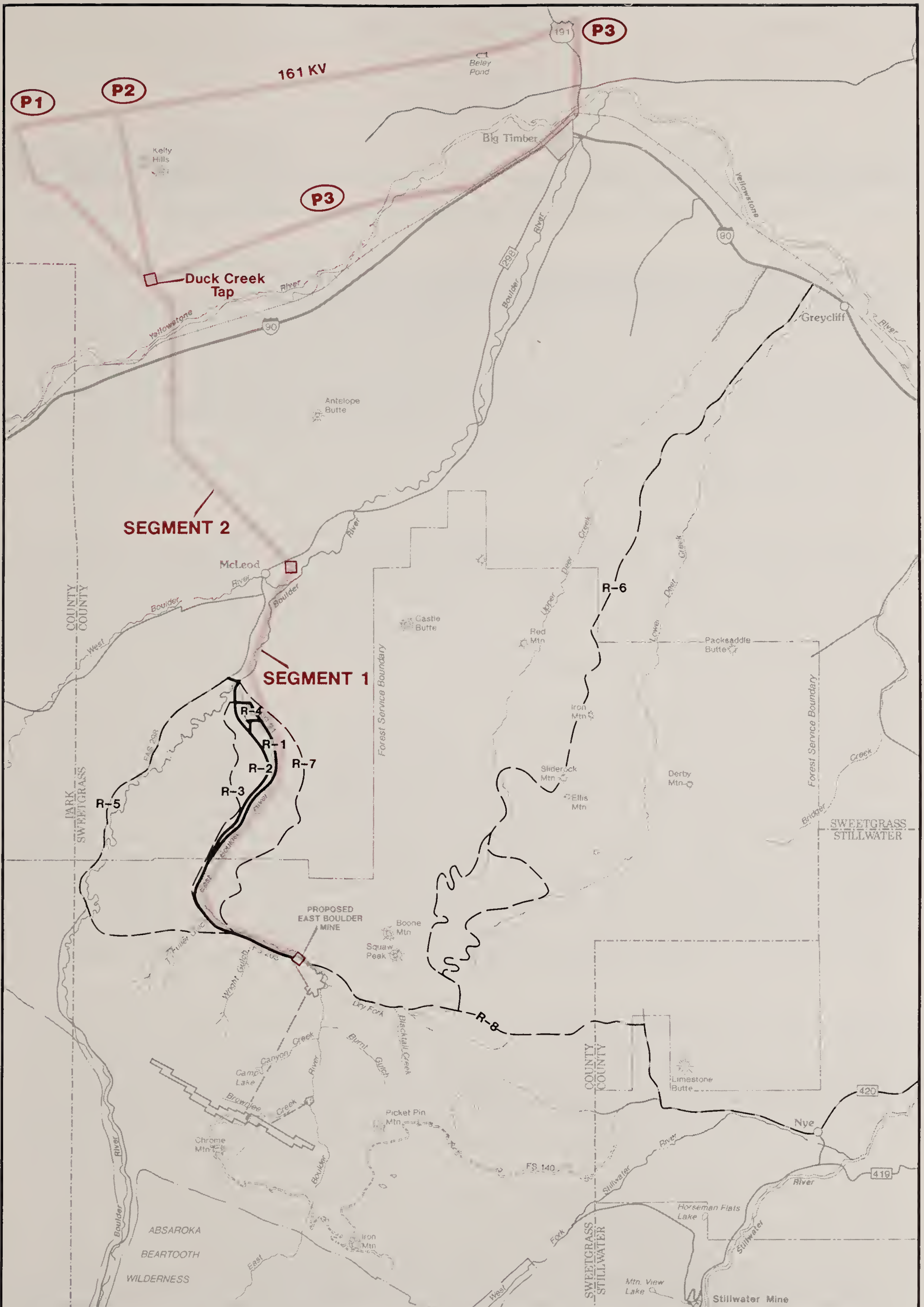
#### 2.4.3.1 Power Segment 1

Segment 1 extends from McLeod substation to the East Boulder adit. The existing line would be upgraded in the current right-of-way from 12.5 kV to 69 kV, and approximately 2.6 miles of new line would be constructed from its current termination point to the mine facilities. For this segment, a new overhead transmission line would be constructed and carried on the uppermost section of poles, and the 12.5-kV circuit (which delivers power to consumer taps) would be "underbuilt" on the same pole. Two types of poles would be used depending on the line location; one, termed the TP-69, has the power lines attached to horizontal insulators located on alternate sides of the pole. The TP-69 would be the pole most commonly used. The other pole, known as a TSS-1, includes two wooden crossarms to which insulators are attached that carry the powerlines. Poles would be located approximately 325 feet apart, depending on ground conditions. Electrical lines would likely hang no lower than 20 feet above ground.

From the substation constructed near the East Boulder Mine Project site facilities, voltage would be stepped down to 13.2 kV for on-site distribution. One feeder would supply power to the mill substation while a second feeder would deliver power to the mine through the East Boulder adit. The site substation would encompass approximately 80 feet by 120 feet, and contain a structure approximately 25 feet high. The area would be encircled by a chain link fence 7 feet high. Power Segment 1 currently follows an existing and active transmission corridor. The detail presented above assumes the existing corridor would be used and modifications would occur in the form of line and pole upgrade. However, as noted in Section 2.4.2, a new power corridor could follow a different access route to the permit area. This change in Power Segment 1 routing is dependent upon road access route evaluation and decision analysis. Therefore, separate alternatives have not been developed for power routing in Segment 1, but are incorporated into the road alternatives described in Section 2.4.2.

#### 2.4.3.2 Power Segment 2

Segment 2 consists of a length of transmission line currently carrying 50 kV from the Duck Creek Tap to McLeod substation, where there is an existing tie-in for Park Electric to Montana Power Company's 50 kV transmission system, which runs along the north side of the Yellowstone River. This segment would require upgrade from 50 kV to 69 kV. The current line is already insulated for 69 kV but is only operated at 50 kV. No new poles would be required, with only minor changes at the power taps.




LEGEND

R-1 VALLEY (SG 31)
R-2 BENCH
R-3 HILL
R-4 BENCH-VALLEY
R-5 GREEN MOUNTAIN
R-6 IRON MOUNTAIN
R-7 EAST SIDE OF EAST BOULDER
R-8 DRY FORK/SQUAW PASS/ MEYERS CREEK

POWER LINE CORRIDOR

SUBSTATION

N

0 1.25 2.5
SCALE IN MILES

**POWERLINE AND ROAD CORRIDORS**

FIGURE 2.4-3

Alternatives have not been developed in this EIS for the first two segments of transmission corridor. It should be noted that Park Electric did identify alternative siting of a portion of Segment 1 to be located on a ridge north of Elk Creek, prior to rejoining the existing line near the mouth of the East Boulder River canyon. However, SPGMR has indicated in Figure 3.1-3 of its Plan of Operations that no new line would be established from McLeod to the current line's termination point. Therefore, the first two segments, as proposed by SPGMR in the mine permit application, are included as common elements for each of the following alternatives which have been developed for Segment 3. Potential impacts for the alternatives including the two segments described above are presented in Chapter Four.

#### 2.4.3.3 Power Segment 3

Alternatives have been developed by Park Electric for delivery of power to the Duck Creek Tap, described herein as Power Segment 3. Park Electric identified a preferred alternative for this segment, although it is somewhat unclear whether SPGMR merely presents alternatives with no preference, as indicated on page 3-16 of the Plan of Operations, or whether the SPGMR uses the preferred alternative of Park Electric, as suggested by response to Question H, page 12 of Appendix I, First Completeness Review. Regardless, DSL and GNF have considered three alternatives for this segment of power line and recommend that Alternative 5A be preferred within Power Segment 3.

Alternative 5A - Power Corridor 1 (P1)

Montana Power Company (MPC) has an existing 161-kV transmission line, which runs generally east-west and is located approximately 6-7 miles north of the Yellowstone River in the area of interest. Alternative 5A would entail construction of a 161-69 kV substation adjacent to this powerline near the county road in Section 17, T1N, R12E. A 69-kV transmission line would be constructed from the new substation approximately 5.7 miles south-southeast to the Duck Creek Tap, which is located in Section 6, T2N, R13E. The corridor within which the new line would be constructed would be approximately one-mile in width; actual cleared right-of-way would be between 30 and 50 feet. The transmission line would be carried on a two-pole, wooden H-frame structure. The poles would stand approximately 40 feet above ground and approximately 600 feet apart. The line would get no closer than 20 feet above ground. From the Duck Creek Tap, the line would extend south as described in Segments 2 and 1.

Alternative 5B - Power Corridor 2 (P2)

Under Alternative 5B, the 69-kV power connection would also be made on the MPC's 161-kV line; however, the substation would be located approximately 2.5 miles east of the location proposed in Alternative 5A, on the border of Section 11/14, T1N, R12E. The corridor, also 1 mile in width, would extend approximately 4.5 miles in a southerly direction to the Duck Creek Tap. An access road would have to be constructed to the 161 - 69 kV substation. Pole and line construction elements would be the same as for Alternative 5A. From the Duck Creek Tap, the line would extend south as described in Segments 2 and 1.

Alternative 5C - Power Corridor 3 (P3)

A 50-kV transmission line exists which runs from the North Big Timber 161-69 kV Auto substation, southwest approximately 2 miles along the interstate, and then west to the Duck Creek Tap and beyond. Under this alternative, approximately 15 miles of the 50-kV line would be upgraded to 69 kV until it reached

the Duck Creek Tap. This existing line is very old and would require new poles, new taps for service, and new line. Significant changes would be required to upgrade this system. From the Duck Creek Tap, the line would extend south as described in Segment 2.

Alternative 5C is considerably different in scope than Alternatives 5A or 5B. According to Park Electric Co-Operative, Inc. (11/15/90), implementation of Alternative 5C would require rebuilding 15 miles of 50 kV line currently owned by Montana Power Company. Conversion of this line would necessitate expensive conversion of existing facilities, and the additional length would create excessive voltage regulation. Because of the difficulties inherent in the conversion of the 50-kV line, alternative 5C has not been carried forward for detailed analysis and is dropped from further consideration in this EIS.

An alternative dropped from further consideration was one proposed by MPC to bring power from the Nye side via Meyers Creek and the Dry Fork to the East Boulder Mine. This was dropped because of environmental concerns from creating a corridor and its associated access road.

#### 2.4.4 Alternative 6 - Water Treatment Methods

The agencies have determined that SPGMR's proposed action, if not modified, would degrade water quality in the vicinity of the mine and mill facilities. Specific concerns arise from two sources. First, mine water would likely contain levels of some compounds such as nitrates, certain metals, and total suspended solids, which exceed concentrations naturally present in groundwater and the East Boulder River. This determination is based on modeling of mine discharge water mixing with groundwater and surface water, the results of which are contained in Sections 4.2.2 and 4.3.2. The modeling results indicate that discharge of mine water directly to the East Boulder River would violate Montana's nondegradation rules, as would discharge to percolation ponds because of the impact on groundwater. However, an analysis of information presented to the Water Quality Bureau indicates the water quality resulting from the mine discharge water mixing with groundwater and surface water would not likely exceed drinking water standards or water quality criteria. Second, SPGMR has proposed that sewage generated on site would be disposed in a large septic system. Septic systems typically introduce nitrates, and possibly other nutrients and bacteria, into groundwater. This action would also violate Montana's nondegradation rules.

SPGMR was notified of the problems associated with water quality degradation and subsequently indicated to DSL, GNF, and DHES that a petition would be prepared requesting that the Board of Health and Environmental Sciences grant a request for modification of ambient water quality in the East Boulder River. Montana nondegradation rules prohibit degradation of applicable State waters without first considering alternatives to water degradation. In no instance, however, can the amount of degradation to surface waters or groundwater exceed drinking water standards established to protect human health or water quality criteria established to protect aquatic life or beneficial uses.

To provide the Board with the information necessary to make an informed decision on this petition, the agencies have evaluated three water treatment alternatives in this EIS, each of which provides a different degree of impact to area water quality. The three alternatives are: (1) construction and operation of a water treatment plant to reduce concentrations of nitrates and other compounds in the discharge stream to levels near those currently found in the East Boulder River and area groundwater; (2) construction and operation of a water treatment system designed to remove a percentage of nitrates and suspended solids

from mine discharge water; and (3) minor modification of SPGMR's proposed mine water treatment system such that no compounds would be present in discharge at concentrations greater than water quality criteria or drinking water standards. Each of the alternatives are briefly described in following sections.

The alternatives description is based on a preliminary draft assessment of water treatment technologies prepared by Hydrometrics, Inc. (Hydrometrics 1991b) for SPGMR to be used in the nondegradation petition. Cost estimates of the alternatives are based on a treatment life of approximately 40 years. This assumption is considered reasonable since the mine life is estimated at 27 years, and treatment would continue for approximately 14 more years. During the post-mining period, nitrate and metals concentrations in mine discharge water would probably lessen, so treatment may not be required after some unknown period of time. Analysis of the impacts of these alternatives on the environment is included in Chapter Four.

Solid waste generated by a wastewater treatment facility could be disposed in the mine area or offsite, depending on the amount of waste generated and the properties of the waste. If the waste is considered non-hazardous, it may be possible and efficient to place it in the tailing impoundment. The addition of approximately 320 $yd^3$ per year would not significantly affect the impoundment capacity. Under this scenario, the waste would be non-hazardous and should not present a threat to the groundwater even if there is a leak in the lined impoundment.

It is possible that waste generated by a water treatment facility would contain sufficient concentrations of inorganic compounds, probably metals, that it would classify as a hazardous waste by definition of the Resource Conservation and Recovery Act of 1976, as amended ("RCRA"). If the waste is hazardous various restrictions could apply concerning treatment, storage, and disposal methods. It is difficult to describe the exact scenario without knowing the properties of the waste material, but a designation as hazardous would likely preclude disposal in the tailing impoundment, and could preclude land disposal at all. The waste could require further treatment to solidify the materials or stabilize the potentially hazardous compounds to prevent leaching out of the matrix. Because of the relatively low volumes of waste which would be generated, it is doubtful that SPGMR would attempt to design and construct a RCRA-compliant, on-site disposal facility. It would be most cost effective and efficient to transport the material to a permitted, off-site treatment or disposal facility.

If a waste generated under a water treatment alternative was considered hazardous, and SPGMR requested RCRA approval to dispose on site, the public would be allowed full review and comment under the public notice requirements of RCRA. If the waste is not considered hazardous, DSL and GNF will consider the waste properties and SPGMR's waste disposal proposal. A decision as to whether public review is warranted will be made at that time. However, the information would be available to the public and a public notice would be printed if and when any such proposal is submitted. Classification of the waste as a regulated hazardous waste would depend on results of standard leachability tests, which SPGMR would have to perform if a wastewater treatment system is necessary.

Finally, it should be noted that the treatment methods discussed under Alternative 6 were not formulated to address problems associated with the sewage disposal system. The preliminary costs and design specifications presented here are based on projected discharge flow rates from the mine only. However, it is believed that should problems arise from the septic system, such as degradation of groundwater by nitrates, an interceptor well could be installed to capture the contaminant "plume" and prevent it from migrating. The captured flow could then be routed through the appropriate treatment stream.

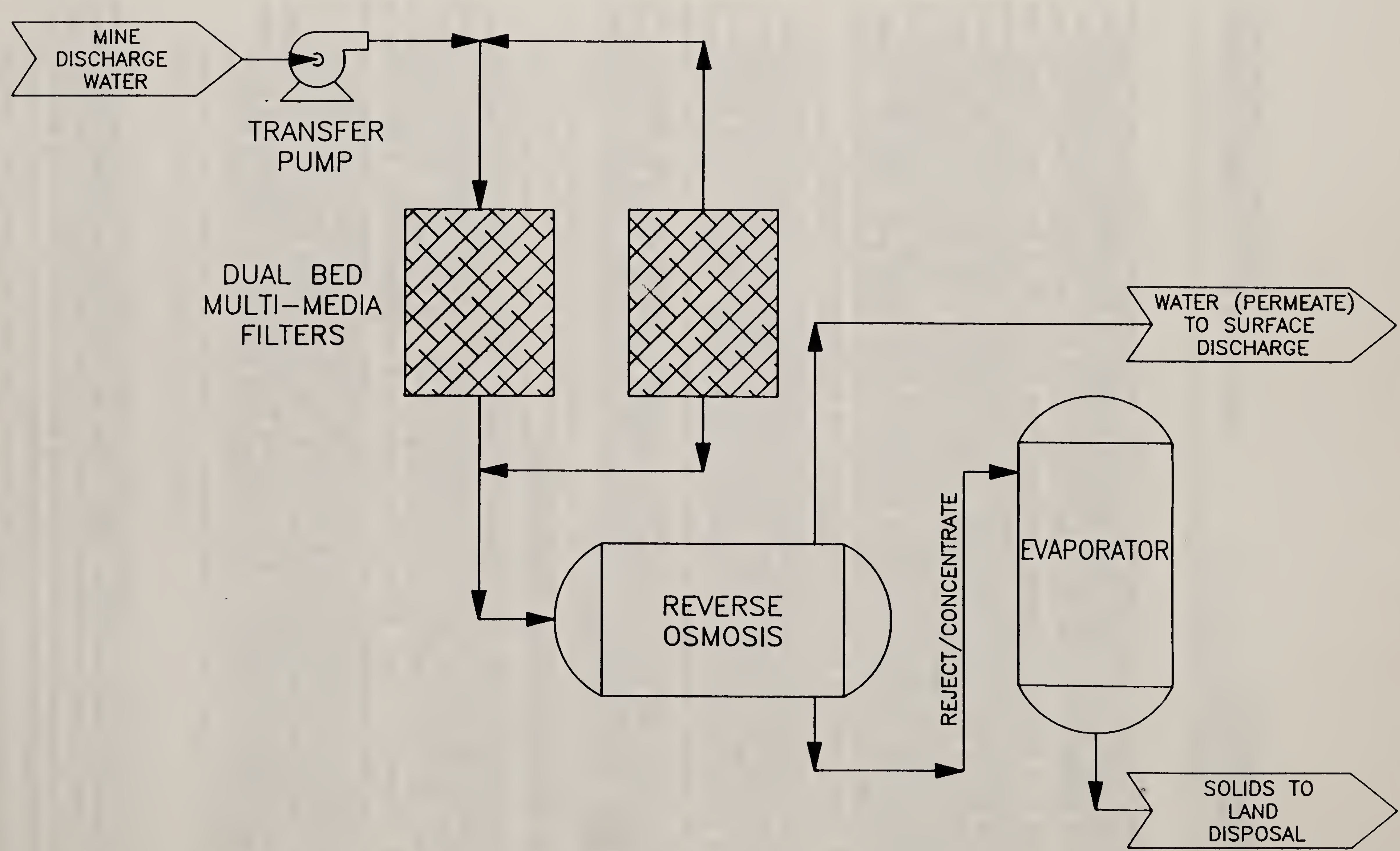
Land application is a commonly used method of distributing nitrates and other nutrients in an aqueous form across a large surface area. Vegetation may uptake the nutrients and soils attenuate residual compounds, thereby reducing the amount of contaminant migration through the subsurface. Land application was not considered in this EIS because of the limited space available in the proposed permit area for such a process, but it could be a treatment technology worth considering by SPGMR if the Board of Health and Environmental Sciences (BHES) grants a modification of existing water quality[1]. However, the agencies estimate that an additional 60 to 80 acres would be required to implement land treatment, and this would require an expansion of the permit area through a permit modification, if the mine permit is in fact issued. Other viable treatment technologies may exist, but the primary intent of the alternatives described in the following sections is to provide the BHES with the information necessary to make an informed decision with regard to the petition. The Board would likely not stipulate a particular treatment technology, but rather would set ambient levels for SPGMR to meet. It would be up to SPGMR to determine the most efficient manner in which to meet the Board's requirements without violating permit requirements.

Sections 2.4.4.1 through 2.4.4.3 contain information which was developed by Hydrometrics for the SPGMR's nondegradation petition. The agencies have, in some instances, summarized or clarified the description of treatment technologies so as to be more concise and easier for public consumption, but the intent was to provide an accurate representation of SPGMR's technology analysis. However, to ensure third-party objectivity, the agencies also prepared an independent assessment of the three primary water treatment technologies, including independent cost estimates. The agencies' treatment technology assessments are briefly described following each of the treatment technology alternatives. Section 2.4.4.4 presents an independent cost analysis compared to the implementation and operations and maintenance costs identified by Hydrometrics in SPGMR's petition.

#### 2.4.4.1 Alternative 6A - Wastewater Treatment Facility

Conventional technologies could be combined with specialized processes in a wastewater treatment system that would remove nitrates, suspended solids, and metals of concern to concentrations comparable to existing surface water and groundwater quality. Implementation of this alternative would result in very little degradation of the East Boulder River water quality (Figure 2.4-4). The only analyte which is predicted to increase is nitrogen by 0.05 mg/l. Because nitrates and nitrogen compounds are more difficult to treat in wastewater than other compounds of concern noted for this project, the treatment technologies described in this alternative are selected for their nitrogen removing capability. Conventional technologies such as coagulation and flocculation are described in Alternative 6C. The information presented in this section is preliminary with regard to the design requirements for the East Boulder Mine Project. More information on feed stream parameters, site location, discharge points, flow rates, power requirements, and many other variables would need to be collected in order to accurately cost and configure a treatment system.

[1] As mentioned previously in Section 2.3.6.2, SPGMR has also proposed that unknown volumes of the discharge water from the mine "would be used around the East Boulder adit site for spray irrigation of ongoing mine reclamation areas and as a possible source of makeup water at other site facilities. Spray evaporation would be used, whenever practical, as a low volume disposal alternative to the primary water disposal pond(s) system." Although the Plan of Operations does not refer specifically to the use of spray evaporation as a means of mine discharge water treatment (i.e., land application), the effect would be the same.

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|---|---|
| Job No. : 22516E | ALTERNATIVE 6A1 WASTEWATER TREATMENT FACILITY |
| Prepared by : ESR | |
| Date : 11/15/91 | FIG. 2.4-4 |

Nevertheless, the following technologies in various combinations could probably be used to remove nitrogen and other compounds of concern from water discharge:

Reverse Osmosis

Reverse osmosis is a treatment process whereby contaminants from aqueous wastes are removed by passing the waste stream, at relatively high pressure, through a semipermeable membrane. At typical operating pressures of 200 to 800 psi, clean water or permeate (the liquid being treated) is forced through the membrane, leaving a concentrated waste stream of reduced volume behind as membrane rejection. Reverse osmosis removes approximately 90 percent of dissolved chemical constituents from feed water and up to 97 percent of nitrogen in typical wastewaters (treatment efficiencies for discharge of the type being considered on this project are not known). It requires a relatively particulate-free feedwater to prevent membrane fouling. Prior treatment of the feedwater through a conventional technology such as sand filtration could be used to remove the suspended solids and prevent membrane fouling. Figure 2.4-4 presents a simplified sketch of a potential layout for reverse osmosis system.

Approximately 5 to 10 percent of the feedwater would be rejected during the process and must be disposed or evaporated. This can present a problem because the rejected water could contain 10 times or more higher concentrations of metals, dissolved solids, and other compounds. Forced evaporation of the rejected water could be used in conjunction with reverse osmosis to reduce this problem. Forced evaporation would generate approximately 320 $yd^3$ of dry solids per year which could presumably be disposed in the tailing impoundment while the mine is operating. After mine closure, solids would need to be disposed off site at an appropriate disposal facility, unless a properly protective disposal cell could be sited in the mine permit area. Depending on the amount of metals present in the solid waste, a biological treatment such as land-farming could be used to reduce organic contaminant concentrations. The waste generated could conceivably have metals concentrations high enough that the waste would classify as a characteristic hazardous waste under the provisions of the Resource Conservation and Recovery Act of 1976, as amended (RCRA). This would necessitate use of a permitted hazardous waste disposal facility, assuming the waste is not prohibited from land disposal.

Hydrometrics (1991) estimated costs for implementation of this water treatment alternative, based on a number of assumptions, including 737 gallon per minute (gpm) water inflow; estimated energy requirements of 1,800 kilowatt-hours per day; estimated plant operating life of 20 years with one replacement plant at year 20; 60 gpm would be considered reject and require evaporation; 20-year lifetime of the evaporator system with one replacement system at year 20; and sand filtration unit to treat 737 gpm, with an estimated lifetime of 20 years and one replacement unit at year 20. Using the above assumptions and specifications, the preliminary cost estimate is as follows:

Construction:

| | |
|---|---|
| Reverse Osmosis plant | $3.2 million |
| Replacement plant | $6.4 million |
| Evaporation system | $760,000.00 |
| Replacement system | $1.5 million |

| | |
|---|---|
| Sand filtration unit | $310,000.00 |
| Replacement system | $620,000.00 |
| Total Construction/Replacement Costs | $12.8 million |

Operation & Maintenance: (annual costs)

| | |
|---|---|
| Reverse osmosis | $500,000.00 |
| Evaporation | $151,000.00 |
| Sand filtration | $ 20,000.00 |
| Total Operation & Maintenance Costs | $671,000/yr |

The costs presented above are very preliminary and are presented only to indicate the relative cost magnitude of the alternatives being considered.

Forced Evaporation

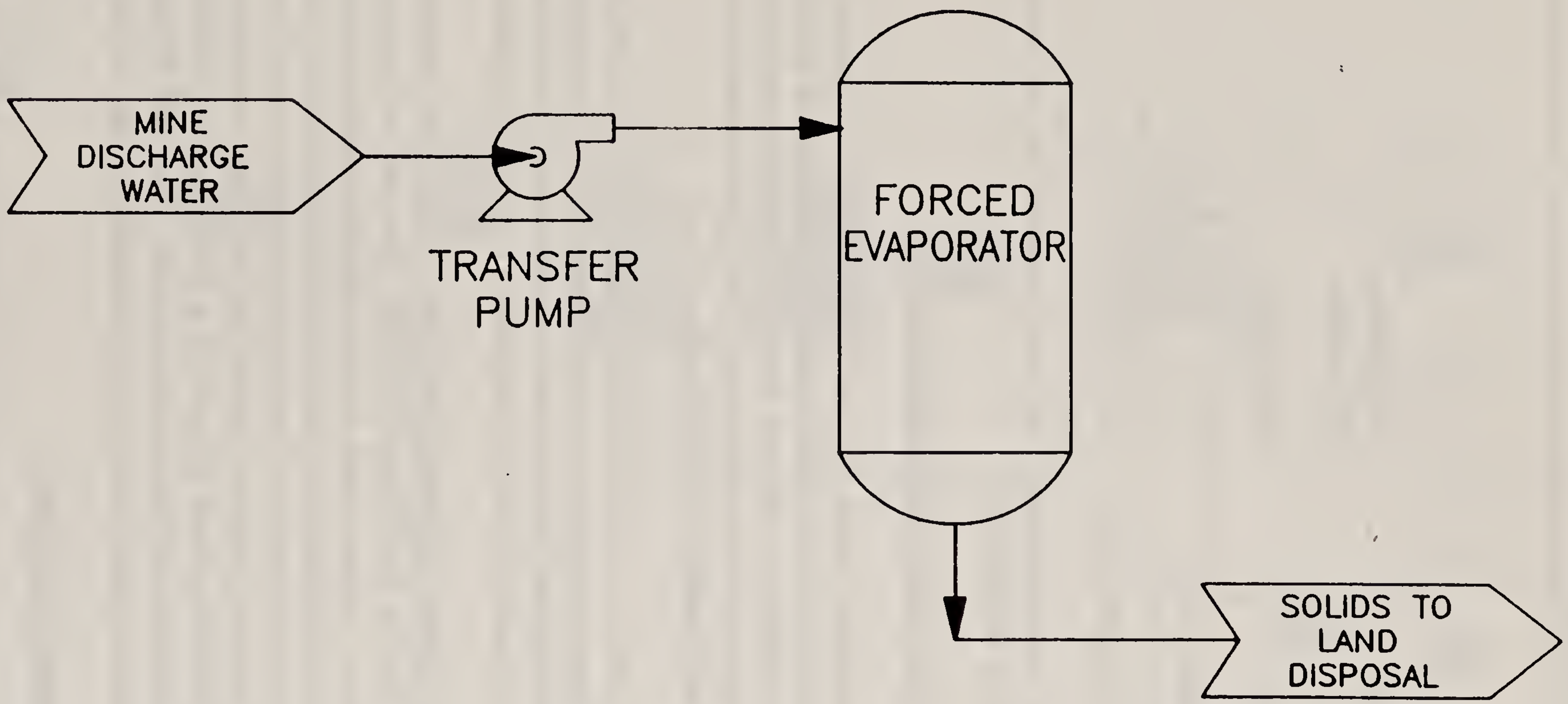
Hydrometrics (1991b) also presented a basic evaluation of forced evaporation, based on the discussion included in the draft EIS for the Montanore Project (FS et al, 1990), as a method of reducing and treating water discharge (Figure 2.4-5). Although this technology is believed unproven as a means of nitrate reduction, it does have treatment advantages, most significant being that minimal discharge would be required. A brief discussion is included here.

The evaporator consists of a vertical tube, falling film unit which reduces the volume of water to approximately one percent of the original feedwater volume. The concentrated wastewater (approximately 7.5 gpm based on an original feed rate of 737 gpm), containing elevated levels of metal salts and other compounds, would be disposed in the tailing impoundment to allow evaporation of the liquid.

The units considered in the Montanore (DEIS) are modular to allow flexibility of placement and rapid relocation, as well as the capability for reconfiguration to expand capacity. This flexibility would likely not be necessary at the East Boulder Mine where all mine water would be discharged through one adit.

Approximately 80 kilowatt-hours of electricity per 1,000 gallons of wastewater would be required to power the unit. Approximately 3 person-hours per shift would be required to run the unit to perform routine maintenance and monitoring. Routine maintenance shutdown would occur annually for a period of approximately 10 days.

Hydrometrics (1991b) estimated costs for the construction and implementation of the forced evaporation alternative using the following assumptions: 750 gpm water feed rate to the unit; 20 year unit lifetime, with one replacement at 20 years; and 80,000 KWH/day power consumed. Using the above specifications and assumptions, Hydrometrics (1991b) estimated the costs to be:

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| Job No. : 22516E | ALTERNATIVE 6A2 WASTEWATER TREATMENT FACILITY |
| Prepared by : ESR | |
| Date : 11/25/91 | FIG. 2.4-5 |

Construction:

| | |
|---|---|
| Forced Evaporation Unit | $9.5 million |
| Replacement | $19.0 million |
| Total Construction Costs | $28.5 million |

Operation & Maintenance: (annual cost)

| | |
|---|---|
| Total Operation & Maintenance Costs | $1.75 million/yr |

The costs presented above are very preliminary and are presented only to indicate the relative cost magnitude of the alternatives being considered.

Agency Analysis of Reverse Osmosis and Forced Evaporation

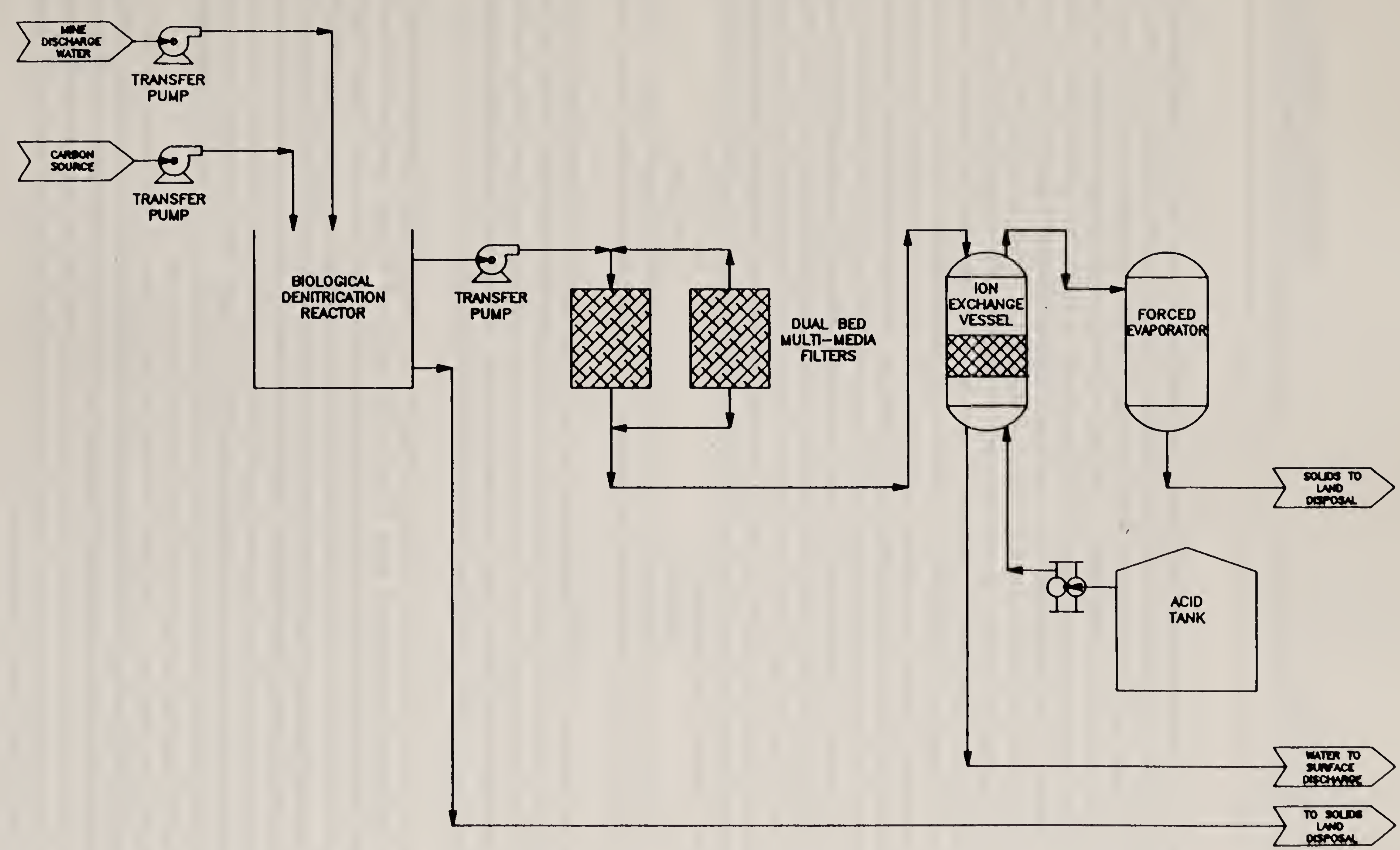
Reverse osmosis (RO) is a treatment option for removing dissolved constituents as well as nitrates. However, the pretreatment required for an RO system must be evaluated and adtional costs incorporated. A sand filter system may not be sufficient should iron and other metals be present in quantities that could increase membrane fouling and thus membrane replacement. Also, pretreatment systems create by-products that require separate handling and possibly special disposal.

Forced evaporation would likely work as a viable treatment process for the mine discharge water to remove nitrates, but the costs for installation, operation, and maintenance of a forced evaporation system preclude it from real consideration. Other options, such as reverse osmosis, would provide an almost comparable level of treatment for much less expenditure (see the comparative cost analysis presented in Section 2.4.4.4).

It is not possible to evaluate the specific engineering practicality of the water treatment options presented in SPGMR's proposal because they are preliminary in nature. However, the agencies do believe that the assumption that a water treatment system would require complete replacement after twenty years is unrealistic; many components of a treatment plant, such as the external structure or mixing tanks, may not need replacement for much longer, while other components such as multi-media filters would require more frequent replacement. These would be costed as part of the Operation and Maintenance expenditures. Also, the mine life is only projected to be about 25 years. It is not reasonable to think that a complete new treatment system would be installed with only five years of mine life remaining. Therefore, the replacement costs listed as part of the construction expenditures are not necessary to this evaluation.

**2.4.4.2 Alternative 6B - Intermediate Treatment**

This alternative is designed to remove some nitrate and suspended solids from the mine water discharge (Figure 2.4-6). It would lessen the amount of degradation to area groundwater and surface waters, and ensure that no violations of drinking water standards or water quality criteria, would occur. However, some degradation of existing water quality would occur. Ion exchange is suggested as a method of achieving this objective.

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|---|---|
| Job No. : 22516E | ALTERNATIVE 6B INTERMEDIATE TREATMENT |
| Prepared by : ESR | |
| Date : 11/25/91 | FIG. 2.4-6 |

Ion exchange is a treatment technology which may be applicable to treat mine discharge water from the East Boulder Mine Project. Ion exchange is based on a principal of interchangeable ions (ions are atoms, groups of atoms or, in some instances, molecules, which have acquired a net electrical charge, either positive or negative) between a solid and a fluid mixture. Cations are exchanged for hydrogen or sodium and anions for hydroxyl ions. Most ion-exchange resins used in waste water treatment are synthetic resins. Treatment involves a sequence of operating steps. The wastewater is passed through the resin until the available exchange sites are filled and the contaminant appears in the effluent. At this point the process is stopped and the bed is backwashed to remove dirt and to regenerate the resin. The removed product/contaminant from the wastewater stream can be concentrated for more controlled disposal. This process is commonly used in water softening systems. Figure 2.4-6 illustrates one possible configuration of a treatment system using an ion-exchange process. Ion exchange could reduce the total nitrogen loadings to area waters, but all nitrogen must be present as nitrates. Since the ion exchange will not convert ammonia or nitrite to the nitrate form, a pre-treatment step of biological denitrification would be required. The denitrification process requires a large amount of organic carbon, typically in methanol form, which may or may not be present at the site. It is possible that the sewage waste generated on site could provide some or all of the required carbon, or carbon sources would need to be imported from off site. Two problems with denitrification at this facility would include the need for a constant flow to regulate microbial (biological) activity, and the cold weather present during most times of the year which inhibits microbial decay. Specific design considerations may be able to address these problems.

Another pre-treatment step would be the removal of suspended solids from the feed water. This could probably be achieved using a sand filtration unit similar to that described for the reverse osmosis treatment.

According to Hydrometrics (1991b) ion exchange is reported to result in a 70-percent nitrate reduction in the discharge; this amount of treatment would reduce maximum nitrate concentrations at the East Boulder Mine Project to approximately 3 mg/l. Ion exchange can conceivably be designed and sized to achieve even greater nitrate removal efficiencies, but it may not be possible to remove sufficient quantity to ensure no degradation of water quality, as for those units described in Alternative 6a.

Ion exchange resin would need to be backwashed frequently to prevent biological fouling of the unit. This activity would require approximately 3,000 lb/day of salt and result in large quantities of brine waste, estimated by Hydrometrics at 30,000 gpd, requiring disposal or biological treatment. Forced evaporation of this waste stream would probably be preferred rather than land application or deep well injection. Forced evaporation would generate approximately 700 $yd^3$ of dry solids per year which could be disposed in the tailing impoundment during mine operation. After mine closure, the waste solids could be trucked to an off-site disposal facility or placed in an appropriate on-site disposal cell. The waste generated could conceivably have metals concentrations high enough that the waste would classify as a characteristic hazardous waste under the provisions of RCRA. This would necessitate use of a permitted hazardous waste disposal facility, assuming the waste is not prohibited from land disposal.

Hydrometrics (1991b) estimated costs for construction and implementation of the ion exchange alternative using a number of assumptions, including: 737 gpm in-flow rate; energy requirements for the ion exchange plant and forced evaporator combined would be 3,124 kilowatt-hours per day; plant lifetime is estimated at 20 years, with replacement at year 20. Using the above specifications and assumptions, Hydrometrics (1991b) estimated costs for this alternative to be:

Construction:

| | |
|---|---|
| Ion Exchange Unit | $400,000.00 |
| Replacement | $800,000.00 |
| Sand Filter Pretreatment Unit | $310,000.00 |
| Replacement | $620,000.00 |
| Forced Evaporator | $320,000.00 |
| Replacement | $640,000.00 |
| Denitrification Unit | Not Costed |
| Total Construction/Replacement Costs (w/o denitrification unit) | $3.1 million |

Operation & Maintenance: (annual costs)

| | |
|---|---|
| Ion Exchange Unit | $97,000.00 |
| Sand Filter | $20,000.00 |
| Forced Evaporator | $63,000.00 |
| Denitrification Unit | Not Costed |
| Total Operation & Maintenance Costs (w/o denitrification unit) | $180,000.00/yr |

The costs presented above are very preliminary and are presented only to indicate the relative cost magnitude of the alternatives being considered.

Agency Analysis of Ion Exchange

Ion exchange is a process that can be used when a high degree of nitrate removal is desired. Nitrate selective resins, as well as cationic/anionic resin combinations, can be used for removing nitrates. A pretreatment step of biological denitrification would not be required. The denitrification step is usually the second step in the removal of nitrogen by the nitrification/denitrification process. First nitrification takes place where ammonia is converted to an intermediate nitrite product, which is then converted to nitrate. The second step takes place where the nitrate is converted to nitrogen gas biologically, under anoxic conditions.

As discussed under Alternative 6a, the agencies believe it unrealistic to cost for an entire replacement plant at twenty years, given the limited project life of the mine. However, other costs for initial construction and operations and maintenance may have been underestimated. See Section 2.4.4.4 for a comparison of cost estimates.

### 2.4.4.3 Alternative 6C - Suspended Solids Removal

This alternative is considered a minimum treatment step that would reduce concentrations of suspended solids and metals, and other chemicals which may adsorb to particulate matter, from the mine discharge water (Figure 2.4-7). The objective of this alternative is to lessen the impact of project wastewater discharge upon area water quality to an extent that no violation of drinking water standards or water quality criteria would occur. However, some degradation of surface waters and/or groundwater would still occur. Suspended sediment removal from wastewaters is a well documented and commonly used process in most municipal drinking water treatment systems which rely on surface water sources. Typical methods of solids removal include coagulation, flocculation, sedimentation, and filtration. The sand filters used as pretreatment steps for technologies in Alternative 6A are methods of suspended solids removal. Suspended sediment removal is applicable to the East Boulder Mine Project to remove excess suspended solids which carry metals and other compounds.

SPGMR's proposed action already includes a flocculation/settling system to remove suspended solids. The following procedures could be used to ensure that sufficient treatment occurs to prevent iron or other compounds from being present in discharge at excessive concentrations. Costs for these steps are not believed to be high relative to the overall water treatment process and, therefore, are not presented here.

#### Flocculation Agent

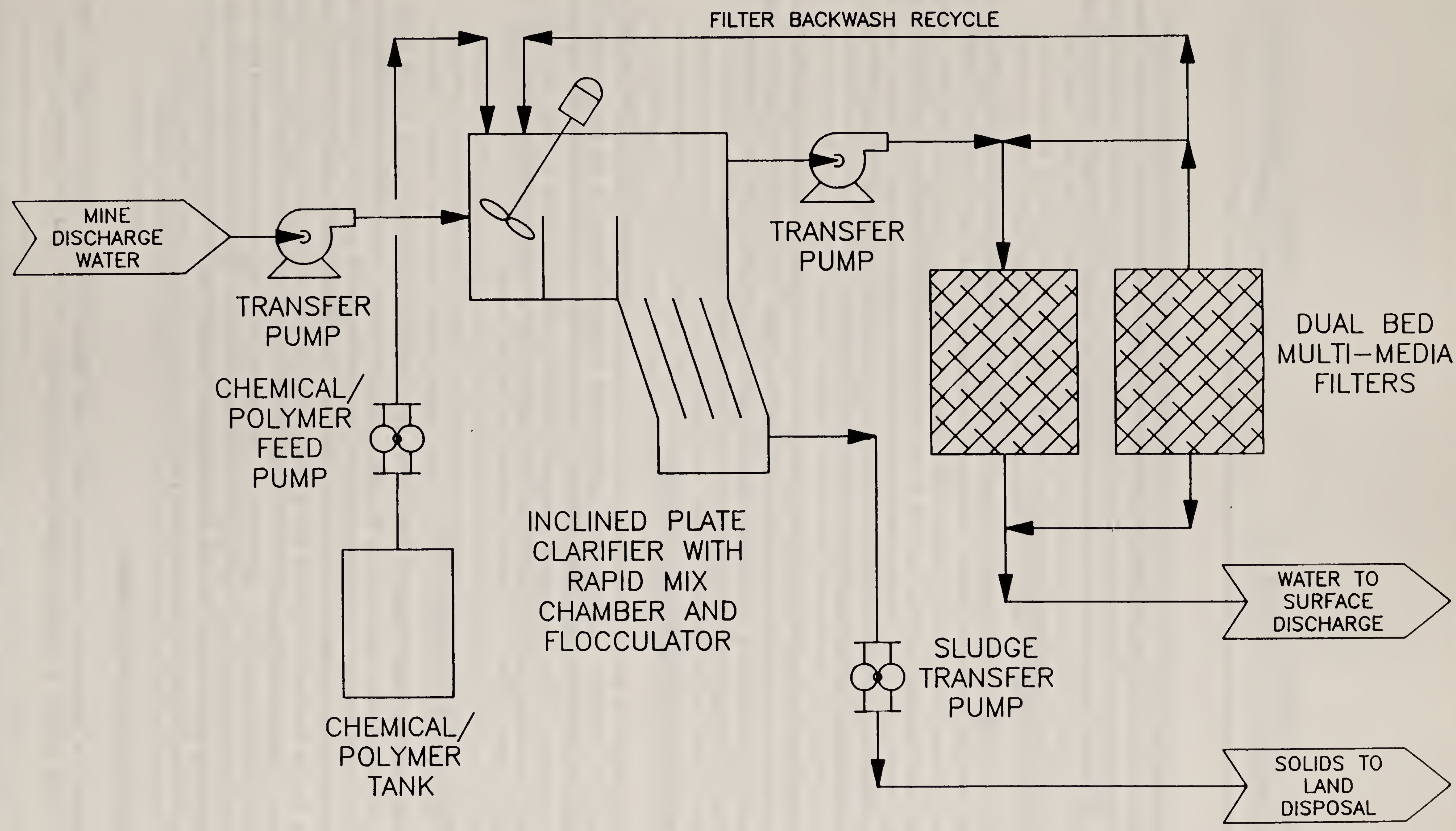
It has been determined that iron and possibly other metals could be present in mine discharge water, under SPGMR's proposed action, at sufficient quantities during low flow of the East Boulder River as to violate water quality criteria (See Section 4.2.2). This determination is based on the quality of mine discharge water at the Stillwater Mine. One reason for this is that the flocculation agent used is ferric sulfate, which may react during treatment to cause relative increases in the amount of total recoverable iron in the discharge water. A possible remedy for this is to use a different flocculating agent such as aluminum sulfate (alum), although a geochemical partitioning model would have to be conducted to determine what effects the use of alum would have on other metals than iron. The most reliable method of evaluating flocculent efficiencies would be to establish a demonstration test at the mine site using mine discharge water.

#### Sand Filter

Another possibility is to use a sand filtration unit after clarification. The sand filter is designed to pick up sufficient suspended solids and adsorbed metals to ensure that no violations of water quality criteria or drinking water standards would occur.

Other possibilities for Alternative 6C could include optimization of Stillwater Mine's existing treatment system to reduce suspended solids and metals concentrations in the effluent even further. This possibility is considered viable because of the relatively low concentrations of iron, for instance, which would have to be removed to meet the water quality requirements presented earlier.

Another option is to try and separate the mine discharge water sources before treatment. For instance, discharge water generated in the main adit prior to the ore zone should have ambient concentrations of metals since it reflects existing groundwater quality. Also, it would have a much lower concentration of nitrates since no blasting agents are used in the approximately 3 miles of tunnel getting to the ore zone.




| | |
|---|---|
| Job No. : 22516E | ALTERNATIVE 6C SUSPENDED SOLIDS REMOVAL |
| Prepared by : ESR | |
| Date : 11/25/91 | FIG. 2.4-7 |

This water could conceivably be discharged to groundwater with relatively little treatment. The water generated in the ore zones, which contains elevated levels of suspended solids, metals and nitrates, would undergo standard treatment. The volume of water requiring treatment should be substantially reduced (since no mixing with clean tunnel water would occur) and, therefore, the treatment costs may be reduced as well.

Agency Analysis of Suspended Solids Treatment

Coagulation/flocculation and filtration are conventional treatment processes that reduce concentrations of suspended solids and undissolved metals. To remove dissolved metals that could potentially contribute to the violation of water quality criteria, chemical addition would be necessary to precipitate out these metals. Suspended solids removal processes, as well as the precipitation/filtration process, generate a sludge by-product. This by-product may require dewatering or stabilization before disposal. Additional costs are associated with a simple solids removal system. This type of process may be required for each of the nitrate removal systems except for the biological nitrification/denitrification.

The alternatives presented above are not the only methods of ensuring that groundwater and surface water quality are preserved or impacted to the minimum extent practicable. However, they do provide a range of alternatives to the Board of Health and Environmental Sciences and the public for consideration of SPGMR's anticipated petition for a modification to the ambient water quality.

#### 2.4.4.4 Independent Analysis of Water Treatment

The agencies conducted an independent assessment of the three water treatment technologies prepared by Hydrometrics for SPGMR's nondegradation petition which focused primarily on the costs required for implementation and operation of each technology. Independent cost estimates for the three alternatives were also conducted. The independent assessment includes a brief description of each alternative, a discussion of the assumptions included in the cost analysis, and a comparison table summarizing the alternatives.

Alternative 6A - Water Treatment Facility

Reverse osmosis (RO) is a treatment option for removing dissolved constituents as well as nitrates. However, the pretreatment required for an RO system must be evaluated and additional costs incorporated. A sand filter system may not be sufficient should iron and other metals be present in quantities that could increase membrane fouling and thus membrane replacement. Also, pretreatment systems create by-products that must also be handled. The size of such a facility would vary depending on site-specific construction criteria, but a typical building housing the reverse osmosis equipment (including evaporator and pre-filters) would be two stories high and cover approximately 3,200 square feet. A larger forced evaporation unit would be required if reverse osmosis were not employed. The size of this building is estimated to be 4,200 square feet. The holding pond necessary for treatment equipment downtime could be approximately 10 feet deep, cover approximately 40,000 square feet (about 1 acre), and store approximately 3,000,000 gallons.

Alternative 6B - Intermediate Treatment

Ion exchange is a process that can be used when a high degree of nitrate removal is desired. Nitrate selective resins as well as cationic/anionic resin combinations can be used for removing nitrates. A

pretreatment step of biological denitrification would not be required. The denitrification step is usually the second step in the removal of nitrogen by the nitrification-denitrification process. First nitrification takes place where ammonia is converted to an intermediate nitrite product, which is then converted to nitrate. The second step takes place where the nitrate is converted to nitrogen gas biologically under anoxic conditions. The size of such a facility would vary depending on site-specific construction criteria, but a typical building housing the ion exchange equipment (including pre-filters) would cover approximately 3,800 square feet. The holding pond necessary for treatment equipment downtime could be approximately 10 feet deep, cover approximately 40,000 square feet (about 1 acre), and store approximately 3,000,000 gallons.

Alternative 6C - Suspended Solids Removal

Coagulation/Flocculation and filtration are conventional treatment processes that reduce concentrations of suspended solids and undissolved metals. To remove dissolved metals that could potentially contribute to the violation of water quality criteria, chemical addition would be necessary to precipitate out these metals. Suspended solids removal processes as well as the precipitation/filtration process generates a sludge by-product. This by-product may require dewatering or stabilization before disposal. Additional costs are associated with a simple solids removal system. This type of process may be required for each of the nitrate removal systems except for the biological nitrification/denitrification. The size of such a facility would vary depending on site-specific construction criteria, but a typical building housing the filtration equipment would cover approximately 1,200 square feet. The holding pond necessary for treatment equipment downtime could be approximately 10 feet deep, cover approximately 40,000 square feet (about 1 acre), and store approximately 3,000,000 gallons.

East Boulder Water Treatment Options - Basis for Capital and Operating/Maintenance Costs

There are four water treatment options under consideration in this study including the proposed action (Table 2.4-1). One of the options, clarification/filtration (similar to SPGMR's proposed action), employs conventional water treatment methods. The main objective of this option would be described as a minimum treatment, removal of suspended solids. The three other options employ advanced water treatment methods potentially capable of meeting nondegradation levels for total dissolved solids (100 mg/l) and nitrates (0.5 mg/l). The cost estimates for these three options have been developed based on attainment of the nondegradation levels.

Other assumptions used during development of the cost estimates include:

1. Mine water is supplied to the treatment system at nominal pressure.

2. Low risk basis includes a 3 million gallon lined wastewater retention pond and pumping system for three days worth of wastewater storage in the event of an extended treatment equipment downtime.

3. Majority of treatment equipment is provided on skid mounted assemblies, pre-piped and wired as much as feasible.

# TABLE 2.4-1

## COMPARISON OF CONVENTIONAL AND ADVANCED WATER TREATMENT OPTIONS - EAST BOULDER MINE

| Treatment Alternative | Treatment Category C-conventional A-advanced | Components | | | Removal Efficiency Final Concentration[b] | | | | | Costs (Millions[d] of Dollars) | | Total Energy Requirements kWh/day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sand Filter | Forced Evaporation | Brine By-Product | Suspended Solids | Dissolved Solids | Ammonia | Nitrate | Metals | Initial | Annual O&M | |
| Clarifier[h] | C | Yes (Optional)[a] | No (No) | No (No) | 99% | 0 | 0 | 0 | 50-99% | 1.13 (*)[e] | .25 (*) | 860 (*) |
| Reverse Osmosis | A | Yes (Yes) | Yes (Yes) | Yes-150 GPM (Yes-60 GPM) | >99% | 90% | 95% | 1 mg/l | 90% | 5.60 (4.27) | 2.09[f] (.67) | 18,480 (1,800) |
| Ion Exchange | A | Yes (Yes) | Yes (Yes) | Yes-28 GPM (Yes-21 GPM) | >99% | <5% | 90%[c] | <1 mg/l | 90% | 4.41[d] (1.03) | 1.08[g] (.18) | 7,520 (3,124) |
| Forced Evaporation | A | No (No) | Yes (Yes) | Yes (Yes-7.5 GPM) | >99% | 5 mg/l | Varies | >99% | 99% | 6.06 (9.50) | 2.09 (1.75) | 68,750 (80,000) |

[a] Items denoted by parentheses are Hydrometrics assumptions and cost estimates
[b] These are typical removal efficiencies for wastewater treatment streams. Treatability testing is required to validate efficiencies.
[c] Also includes nitrification system.
[d] WCC costs include a 3 million gallon lined retention pond (3 days storage) in the event of treatment equipment downtime.
[e] (*) Information not provided or distributed in other costs by Hydrometrics.
[f] Includes membrane replacement every 3 years
[g] Includes resin replacement every 4 years

[h] Similar to SPGMR'S proposed settling ponds.

4. All treatment equipment is installed indoors in a preengineered metal building complete with insulation package, gas heat, lighting, potable water, and facilities.

5. No installed standby equipment is included.

6. Cost of land is not included.

7. Electrical power cost assumed at $0.05/kw-hr.

8. Contingency of 20 percent included on both capital and O&M costs.

9. Major treatment equipment costs are "budget" quality estimates from equipment vendors.

10. Installation of equipment and other infrastructure estimated as a percentage of equipment costs.

11. A cost for operating labor has been included but assumes that no dedicated new personnel will be hired to directly support only the treatment system.

Additional information regarding development of the agencies' cost estimates may be reviewed in the East Boulder Project files at Department of State Lands, in Helena, and Gallatin National Forest offices in Bozemen and Big Timber.

## 2.5 ALTERNATIVE 7 - PROPOSED ACTION WITH MODIFICATIONS

Mitigation is considered to be specific actions that could be taken to minimize or avoid impacts on the resources that would be affected by SPGMR's proposal. Mitigating environmental effects may involve changing or modifying the proposed actions that would cause the effects on resources. According to Council on Environmental Quality regulations 40 CFR 1508.20, mitigation may include:

- Avoiding the impact altogether by not taking a certain action or parts of an action

- Minimizing impacts by limiting the degree or magnitude of the action and its implementation

- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment

- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action

- Compensating for the impact by replacing or providing substitute

An example of the application of mitigation will help to demonstrate its use. Roads for mines are often developed in drainageways so as to make use of natural features for barriers. However, this practice can in some instances destroy or disrupt wetland and riparian areas. If siting of roads outside the drainageway is not feasible, the regulatory agencies could require the mine proponents to mitigate the loss by creating new wetland habitat elsewhere in a quantity equal to or greater than that to be destroyed. This is a

"compensation" type of mitigation. In the same example, a type of "avoidance" mitigation would be to not allow development of the roads.

Development of mitigation measures occurs after the environmental consequences of a proposal and alternatives to the proposal are determined. DSL and GNF have evaluated SPGMR's proposal, determined potential environmental consequences, and formulated a proposed action with mitigations and modifications. The rest of Section 2.5 provides information on the specific additional requirements which, when combined with SPGMR's proposal, constitute Alternative 7. Note that only specific modifications to SPGMR's proposal are described here, prefaced by a short rationale for the mitigation. This alternative should be considered in conjunction with an evaluation of Section 2.3. In addition, it is understood that SPGMR would abide by the mitigation measures set forth in the Jackpine Environmental Assessment Decision Notice, as amended (see Appendix B). SPGMR would also follow Best Management Practices of the GNF, as established in the U.S. Forest Service "Soil and Water Conservation Practices Handbook," May 1988, FSH 2509.22. Mitigation measures are subject to modification or deletion at the discretion of the agencies if it can be shown a mitigation measure is no longer relevant. Likewise, if a mitigation measure is found to be insufficient to address actual impacts, further mitigations may be required at the discretion of the agencies. This responsibility and authority of the agencies is open to public review and comment.

The agencies recognize that if the Board of Health and Environmental Sciences approves SPGMR's Petition for Modification of Ambient Water (in the East Boulder River), the conditions established for compliance may necessitate modifications to the mine operating plan. One potential change would be an expansion of the permit boundary to accommodate a sewage and/or mine discharge treatment option. A sensitivity analysis for expansion of the permit boundary (of up to 20 acres), to contain possible sewage treatment facilities and mine waste water treatment facilities, has been prepared by the Gallatin National Forest. This information is available for review in the project files. The analysis reveals that expansion of up to 20 acres at the East Boulder Mine main permit area, for the facilities described, would not adversely affect the environment, so long as the expansion did not occur in the floodplain, and the sewage treatment plant provided for adequate protection from groundwater contamination.

### 2.5.1 Mine Water Drainage

It is anticipated that the mine would continue to drain groundwater forever. There is a concern that portal plugs would not be effective in preventing drainage if a large volume of water backs up behind the plug(s), since water would tend to escape through cracks or fissures, or blow the plug out because of hydraulic pressure. As a result, this alternative requires that portal plugs be omitted and drainage water be channeled to the percolation ponds. SPGMR would be required to develop a plan for pond maintenance so that appropriate bonding can be set. Bond would be released when adit water quality met background conditions or standards determined by the Board of Health and Environmental Sciences. Once adit water quality is sufficient, either a permanent diversion for adit flow to the East Boulder River must be constructed and satisfactorily reclaimed or a permanent wetlands could be created.

Adits and escape shafts other than the main portal(s) would be plugged when mine operations cease to prevent acc< entry by wildlife or humans, and reduce surface water infiltration to the mine workings.

In addition, drainage from the adit and seepage from the impoundment must be monitored during mine life so that water treatment plans can be reviewed before mine closure and bonds adjusted. Water treatment

would be bonded as a contingency until mine drainage and impoundment seepage meet effluent requirements as determined by the Board of Health and Environmental Sciences, or baseline water quality standards.

### 2.5.2 Surface Water Control

SPGMR has developed plans for channeling surface water runoff away from the tailing impoundment. Procedures for permanent maintenance of this system have to be developed and approved so that appropriate bonding can be set. A system for preventing surface water runoff from entering the facilities area (i.e., berms), as well as a system for channeling surface water runoff within the permit areas to the percolation ponds, clarifiers, or other approved structures which are consistent with Best Management Practices (BMPs) must be designed and approved by the agencies.

Mine planning needs to consider the proximity of crown pillar stopes to surface water resources, so as to minimize potential impacts. Where crown pillar stopes are near surface water resources, SPGMR would provide the agencies with site-specific information, prior to development, which considers whether there is or could be a hydrologic connection between the surface water resource and the area to mined.

### 2.5.3 Groundwater Contamination

The percolation ponds irrigation and septic system may introduce nitrates and other contaminants into the groundwater. Nitrates are an especial concern because they do not attenuate (biological breakdown is extremely slow) and could conceivably migrate with groundwater to the East Boulder River. SPGMR would be required to conduct the following steps prior to project initiation in order to prevent groundwater and surface water contamination, or to ensure contamination is detected if it were to occur:

- Specific plans must be developed by SPGMR and approved by the agencies which provide for the monitoring for nitrates and other pollutants in the groundwater. Contingency plans developed as part of this mitigation would be implemented in the event standards and/or permit conditions are violated or would likely be violated. These steps would help to ensure compliance with standards and permit terms. The plans should pay particular attention to "probable impact" locations such as the percolation ponds, tailing impoundment, and septic drain field, as well as other facilities or areas which may contribute to groundwater contamination. It is anticipated that additional soil analysis and monitoring wells would be required.

- The tailing impoundment would be designed so that leachate drains to a collection point or sump. Impoundment leachate would be collected and monitored for quality and quantity. If, after reviewing results of water quality tests, the agencies determine that concentrations of compounds in the liquid are high enough that there would be unacceptable degradation of groundwater if the impoundment leaks, the impoundment liquid would be pumped from the collection sump to a treatment system or recycled in the mining and milling process.

- It is important that percolation ponds do not clog up with fine particles. Periodic cleaning or scraping would be required to reduce this possibility. If clogging occurs to such an extreme that infiltration is prohibited new ponds shall be constructed in a location approved by DSL and GNF.

### 2.5.4 East Boulder River

Analysis of SPGMR's plans for the potential use of surface water in mining and milling operations has raised concern that detrimental impacts could occur to the East Boulder River due to the unusually low flows or even flow disruption. For this reason, this alternative requires that minimum historic low flows in the East Boulder River must be maintained.

### 2.5.5 Water Quality/Quantity Monitoring

In addition to the mitigation measures, SPGMR would be required to submit a monitoring plan to the agencies which meets the following goals and standards. The monitoring plan should be instituted with the idea of providing the agencies with the information needed to assess permit compliance. These goals are based on monitoring guidelines accepted by agencies and regulators.

<u>Surface Water</u>

- The surface water monitoring plan would be formulated so as to detect potential trends in both time and space in a statistically robust manner.
- Sampling stations would be located at historic monitoring locations unless logistics make them impossible to reach.
- Monitoring locations would be located upstream of any significant tributary and, after an appropriate mixing zone, downstream of the tributary. Monitoring would also be conducted in the tributary itself.
- Monitoring would be performed for all constituents presently being tested in the baseline studies. Indicator parameters would be measured monthly, while the remaining constituents would be tested on a seasonal basis.
- Monitoring would be performed on the wastestream on both sides of any treatment facility.
- Suspended sediment investigations would be performed under varying flow conditions during the five year construction period.
- A continuous stream gage would be installed at EBR 5.2 and calibrated in an effort to further define flow regimes.
- Flow measurements would be collected at all locations concurrent with surface water sampling.
- levels, as determined acceptable by the Water Quality Bureau.

Groundwater Monitoring

- The groundwater monitoring plan would be formulated as to detect potential trends in both time and space in a statistically robust manner.

- Groundwater monitoring would include the paired well approach to assess statistically significant differences between upgradient and downgradient wells at the percolation ponds, septic system, and the tailing facility.

- Groundwater would be analyzed for all water quality variables sampled in baseline monitoring.

- Samples should be taken quarterly to ensure sample representativeness.

- A data analysis protocol would be instituted to test for seasonality and serial correlation.

- Springs and seeps in the study area would continue to be monitored during construction, operations, and closure.

Other Sources

Although sampling requirements on the following "systems" fall in neither with surface or groundwater resources, sampling would be required (as indicated) to protect these resources.

- Waste rock piles, including those at the Placer Basin permit area, would be sampled and analyzed for acid producing potential on a quarterly basis. The sampling would help identify high sulfur content rocks that may mobilize metals bound in rocks or reduce pH of stormwater and snowmelt runoff.

- Samples would be taken quarterly from the tailing impoundment and analyzed for those constituents found in the groundwater plan. Additionally, an annual bioassay would be performed on the supernatant tailing impoundment liquids.

Given the low concentrations found in both adit water and "background" locations, procedures using the lowest achievable detection limits would be used for all analysis.

### 2.5.6 Reclamation

#### 2.5.6.1 Tailing Impoundment Reclamation

Reclamation of the tailing impoundment proposed by SPGMR would be difficult, as assessed in Chapter Four. An alternative developed for this EIS established some reclamation requirements for a 2(H):1(V) slope (discussed in Alternative 3), which will help to ensure greater slope stability, greater biological diversity, less visual impact, and allowance for the use of heavy equipment. A specific plan addressing this issue and reclamation for the impoundment must be submitted by SPGMR for agency approval prior to construction. Other mitigations include:

- Tailing impoundment designed as described in Alternative 3.

- At least 50/50 rock armor/resoiled and vegetated slopes is recommended, because soil alone will not hold on such a long slope.

- Vegetation should be established by development of random, soiled slope lengths not greater than 150 feet, which are supported by rock armor slopes.

- Vegetation should be selected based on biological diversity and visual screening ability, as well as the criteria used by SPGMR in the proposed reclamation plan.

The agencies have concerns that reclamation requirements presented by SPGMR may be unduly optimistic, especially concerning the amount and rate of tailing settlement, and the degree of impoundment consolidation at closure (See Section 4.5). The consequences of underestimating settlement could include an inability to sustain the required reclamation gradient, subsequent precipitation recharge and saturation of the tailing mass and cap materials, and vegetative failure. The following procedures must take place at closure to provide definitive design criteria for reclamation:

- Conduct tests of the in-place tailing, at sufficient grid spacing and depth, to define the range of impounded tailing materials properties.

- Determine the degree of consolidation at closure, and estimate the amount of ongoing settlement that may result from pore pressure dissipation and primary consolidation.

- Estimate the amount of settlement that may result from reclamation cap placement and surcharge consolidation.

- Estimate the amount of settlement that may occur during long-term secondary consolidation.

- Model and estimate the rate of consolidation.

- Estimate the depths and volume of reclamation cap fill that will be required to achieve necessary post-settlement contours.

#### 2.5.6.2 <u>Other Reclamation - Modifications to the Reclamation Plan</u>

- SPGMR's proposed reclamation plan would be modified to include reclamation in the Placer Basin permit area. Site-specific plans would be developed based on field assessments conducted in cooperation with the agencies. These individual plans would address key efforts including soil salvage, storage, redistribution, and revegetation, particularly appropriate seed mix selection.

- The mining company would contact the regulatory agency before any wetlands are disturbed. The regulatory agencies would review proposed disturbances in all wetland areas to determine whether there is appropriate justification and need for such an impact. If approved, the agencies would determine whether mitigation measures would be appropriate and would determine the magnitude of the required mitigations. The agencies would review and approve the company's proposed

revegetation mixture (if revegetation is necessary) of seed, transplants, and nursery stock needed, on a site-by-site basis.

- The mining company would revise revegetation and planting mixes to increase the use of site adapted native species, including nursery developed dominant and subdominant grasses, forbs, shrubs, and/or trees and submit them for approval by the agencies. These native seed mixes can be modified at any time during the mine life with the approval of the regulatory agencies, based on availability of native seed.

- The same seed mix as proposed for final reclamation would be used on interim reclamation of disturbances, such as soil stockpiles, to test mixes for appropriateness and to develop data to modify final revegetation mixes over the life of the mine.

### 2.5.7 Road Mitigations

One of the major concerns expressed by the public during project scoping and evaluated during preparation of the draft EIS has been over impacts to East Boulder River valley residents, wildlife, surface waters, and other resources as a result of increased traffic on SG 31. These issues are also important when applied to other candidate road alternatives.

As discussed earlier, SPGMR has indicated that bussing would be implemented for transport of personnel to the mine in order to reduce road traffic. A bussing plan has been submitted to the agencies and is incorporated as part of SPGMR's proposed action (See Section 2.3.18). Impacts of the bussing plan have been analyzed in Chapter Four. Further details on the bussing program such as suitable staging area(s) in Big Timber and/or other locations for buses to pick up workers and materials would be submitted to the agencies when the information becomes available. Other impacts discussed in Chapter Four have necessitated the following road mitigations:

- Establishment of a maintenance agreement with Sweet Grass County before project implementation. This agreement would address such issues as road management, vegetation control, standards for upkeep, dust control, snow removal, runoff and erosion control, and control of noxious weeds. Also, SPGMR would develop procedures for training personnel on the proper use of dust control chemicals or use of the services of a trained and licensed contractor.

- Review and approval of final road design and road modifications by agencies before project implementation.

- Field review and approval by agencies of road route prior to construction.

- Identification of standards for roads on private lands.

- A plan for final road reclamation on private lands must be developed and approved if an alternate road alignment is chosen and the road is not being proposed as a permanent county or public road.

- Construction on un-improved roads for powerline development would be 'restricted during wet periods when soils are subject to rutting and erosion. Temporary roads would be revegetated when construction is complete.

- Employee parking would not be allowed outside the East Boulder permit area boundary on USFS managed lands.

- Roads constructed or upgraded on public lands which serve no beneficial post-mining purpose should be ripped, recontoured, supplied with additional soil, and seeded as deemed appropriate by state and local agencies.

- If chemical dust suppressants are to be used on roads, SPGMR would provide a list of the dust retardants and material safety data sheets to the Forest Service for review and approval. Application of approved dust suppressants would be made in amounts only sufficient to suppress dust, and the application would be made by a licensed, bonded applier.

- Plowed roads must be signed forbidding snowmobiling.

- Establishment of a road maintenance agreement between SPGMR and the Forest Service under the permit for the maintenance of Forest Service roads impacted by mine development and/or operations. The agreement would provide for routine maintenance of the road surface, maintenance of drainage structures, surface rock replacement, dust abatement, removal of slides and debris, and snow plowing specifications.

### 2.5.8 Waste Rock

A plan for more detailed monitoring of waste rock types and volumes would need to be developed by SPGMR, approved by the agencies and implemented upon waste rock production. The plan should address the regular sampling and analysis of waste rock during mine development to assess the potential for acidic conditions, possibly resulting in metal contaminated leachate. The plan should also present steps to be taken should waste rock, which may generate acid drainage, be encountered so that heavy metals are not released to the environment. One such step might be a treatment process which would entail pH adjustment through lime addition. The leachate probably could not be directed through a wastewater treatment facility without pH adjustment, unless the treatment facility was designed in anticipation of this occurrence. Particular attention would have to be given to waste rock from faults and lithologic contact zones.

If space is available at the Frog Pond adit, waste rock would be stored on the permit area. If space is not available, waste rock would be disposed as described in the proposed action, Section 2.3.12.4.

It should be noted that the water monitoring program (see Section 2.5.5) should detect acid drainage from the adit if acidic waters are present.

### 2.5.9 Recreation

One possible effect of the Proposed Plan would be to reduce recreational access to the Dry Fork and Lewis Gulch. This mitigation requires that SPGMR provide suitable access to these areas for public recreationists, including snow plowing a small area in the winter for parking. Also, mine construction, access roads, and transmission lines would be kept away from established hiking trails and other recreational facilities to the maximum extent practicable. Finally, GNF would obtain a trail easement on Graham Creek trail across existing patented lands.

SPGMR would be required to conduct annual employee surveys of recreational use patterns.

### 2.5.10 Soils

Although SPGMR's latest soils and reclamation studies indicate the presence of large volumes of soils in most of the permit areas, some question has been raised as to how accessible those soils would be. Therefore, all soils from disturbed areas which are suitable for reclamation would be salvaged to ensure an adequate reclamation supply. In addition, fuel storage areas would be lined with low-permeability material to prevent contaminant seepage into groundwater. Finally, soils stockpiles should have 2(H):1(V) slopes rather than the 1.6(H):1(V) slopes proposed by SPGMR. If there is not enough room for this configuration, a 1.6(H):1(V) slope would be allowed with additional material, such as netting, to minimize erosion until revegetation stabilizes surface soils.

### 2.5.11 Impoundment Stability

Geotechnical testing is needed under the corner of the impoundment to ensure adequate assessment of impoundment stability. This assessment would be provided to the agencies for review, along with final impoundment designs, prior to construction. The assessment would address the potential for water from percolation ponds to liquify or "grease" impoundment base materials and thereby reduce stability. Piezometers or some other method would be used to monitor groundwater levels in the upgradient tailing dam. If monitoring indicates a flow path which could create a failure boundary, barriers or groundwater drains would be installed to redirect flow around or well under the impoundment.

A Tailing Impoundment Failure plan would be developed which addresses impacts to surface water and mitigations if the tailing impoundment breaks. The plan would address impacts to water quality, fisheries, downstream users, wildlife, and other issues as determined by GNF and DSL.

### 2.5.12 Wildlife

#### 2.5.12.1 Wildlife Mitigation Measures

The following steps would be required to reduce impacts on wildlife.

- Disturbed areas near roads would be seeded with plant species unpalatable to big game. This action would help reduce wildlife road kills and reduce the potential for eagles to feed on carrion on the access route. The plant species list would be coordinated with DSL and GNF.

- SPGMR would be required to notify the agencies at least 48 hours in advance of permitted construction activities, which would result in significant surface disturbance or which may have a temporary impact on wildlife or other identified resources. The DSL and GNF would coordinate their review of the activity with Montana Division of Fish, Wildlife, and Parks (MDFWP) or other affected agencies in order to minimize impacts during the construction activities.

- Helicopter flights would avoid low-level flight in winter along bald eagle feeding/roosting areas of the East Boulder River. Bald eagle feeding and roosting areas, and areas to avoid so as not to disturb peregrine falcons, would be clearly identified in coordination with GNF and MDFWP biologists to ensure helicopter pilots are fully informed of unacceptable flight paths.

- A fence would be installed around the tailing impoundment to prevent wildlife intrusion. Details such as fence height, construction material, number of gates, etc, would be provided to GNF and DSL to evaluate its suitability.

As mentioned previously, SPGMR would also be required to abide by the mitigation measures set forth in the Jackpine Environmental Assessment Decision Notice, as amended (Appendix B). For wildlife, fisheries, and threatened and endangered species, these additional mitigation measures include:

- A locked gate will be installed at the end of existing Forest Road #205.

- A locked gate will be installed at the junction of roads 6644 and 6644a. The roads will be closed by the Forest Service from October 15 to the close of the general big game season, after the mine has been developed.

- All food on site will be made unavailable to bears, and garbage will be stored in bear-proof containers until removed from the area.

- Snow removal operations should not impede wildlife movements across the road.

- Aircraft traffic will avoid flight corridors that interfere with the peregrine falcon reintroduction program. Flight activity will be coordinated with the Forest Service.

- Roadside carrion will be removed to prevent mortality of bald eagles. This program will be coordinated with the Montana Department of Fish, Wildlife and Parks.

- The company will continue a policy of discouraging the carrying of firearms.

- To prevent grizzly/human conflicts, strict control of human refuse will be enforced.

- The company will ensure that employees involved in the Jackpine Project are familiar with the requirements for protection of threatened and endangered species.

### 2.5.12.2 Wildlife and Fisheries Monitoring

In addition to the above wildlife mitigation measures, SPGMR would be required to submit a wildlife monitoring plan to the agencies for approval. This plan must be submitted and approved before issuance of the operating permit. It would be available for public review at the GNF and DSL offices. The monitoring plan must meet the following recommended fish and wildlife monitoring goals. These goals were developed based on review of the preliminary FEIS fish and wildlife sections, public comments and responses, and professional input based on knowledge of the area.

Wildlife

- Bald eagle wintering populations should be monitored annually to determine their status and populations trends. This should follow the methods and guidelines found in Beak and the USFWS annual monitoring survey maintained in Big Timber District files.

- Annual spring peregrine falcon monitoring should be conducted in the general area where suitable habitat exists to determine the status of the existing hack site area and if any new aeries become established in areas that may be affected by mine-related activities.

- Grizzly bear use of the area should be documented and monitored since the project is scheduled to last for about 27 years and grizzlies could potentially move into the area.

- USFS will not monitor management indicator species. The agencies believe there will be minimal impacts and population monitoring would not be able to detect slight changes; only major ones.

Fisheries

- Annual monitoring of fine instream sediment should be conducted to see if predictions are correct and to determine the actual values. This should be done annually during construction phase until levels have returned to normal. Monitoring should be conducted at three places: above any disturbance, immediately below mine site, and below any road disturbance that may affect instream fine sediment that could be detectable.

- In order to establish a baseline condition of metals concentrations in East Boulder fish near the mine site area, the mine company would be required to conduct a sampling and analysis of select species of fish. Fish tissue analyses would be performed to assess levels of certain metal species, including mercury, prior to mine operation, and every three years thereafter, unless the agencies determine that a more frequent program becomes necessary.

- Biological monitoring of streams above and below the mine site would be conducted to determine if there are any adverse biological effects. The biological monitoring should be equivalent to EPA Rapid Bioassessment Protocols. (See comment 1-38).

- A creel survey should be conducted to measure fishing pressure on the East Boulder River. If there are major changes in fishing pressure, fishing regulations may need to be modified or other measures taken such as an increase or decrease in the number of public fishing access points.

### 2.5.13 Wetlands

Powerline towers would not be placed in wetland and/or riparian communities so as to help ensure compliance with Presidential Executive Order 11990 requiring "no net loss of wetlands." DSL, GNF, and the Environmental Protection Agency would be notified if impacts to wetlands or riparian areas not otherwise predicted in this EIS are likely to occur. No dredging or filling of wetlands or riparian areas is allowed without first obtaining permission and permits from the appropriate agencies.

### 2.5.14 Visuals

Because development of the mine facilities would not meet GNF visual quality objectives, a visual management program would be implemented where visual quality standards are not met. The intent of this program would be to insure that, as far as reasonably possible, color, texture, and line of developments would blend as naturally as possible with the surrounding landscape in the coloration and construction of developments, and that terrain features and vegetative screening would be used to reduce the visual impact of developments where such screening was practical and beneficial. Locations where this program may be required include: the area between FS 205 and the East Boulder campground; the millsite; and the tailing impoundment and plateau areas.

### 2.5.15 Noise

Muffling systems would be installed and maintained in good working order on all dedicated facility construction and operation equipment and vehicles to minimize noise levels. Also, fans in ventilation shafts on the East Boulder Plateau would be contained in noise insulated enclosures or located far enough inside the shafts so as to minimize noise near wilderness areas. Also, radar-detector back-up beepers would be used on company or long-term contract equipment on the East Boulder Plateau so that audio warning signals are sounded only when necessary.

### 2.5.16 Health and Safety

In addition to the emergency response plan submitted with the Plan of Operations, SPGMR would provide information on the following:

- Training for local fire departments

- Underground cave-in or accident

- Procedures in the case of accidental spills on Forest Service property outside the permit boundary and on the county road (SG31).

- Procedures for the evacuation of downstream residents in the event of a catastrophic release of tailing, if an analysis of impacts warrants.

### 2.5.17 Placer Basin and Brownlee Creek

Breakouts in the Placer Basin and Brownlee Creek permit areas are scheduled to occur throughout the life of the mine. Breakouts (adit, vents, raises, shafts) must be approved by GNF and DSL before their construction. A cultural resource survey, vegetation survey including wetlands analysis, soil survey, and threatened and endangered species survey must be conducted before approval of any breakouts as deemed necessary by the agencies.

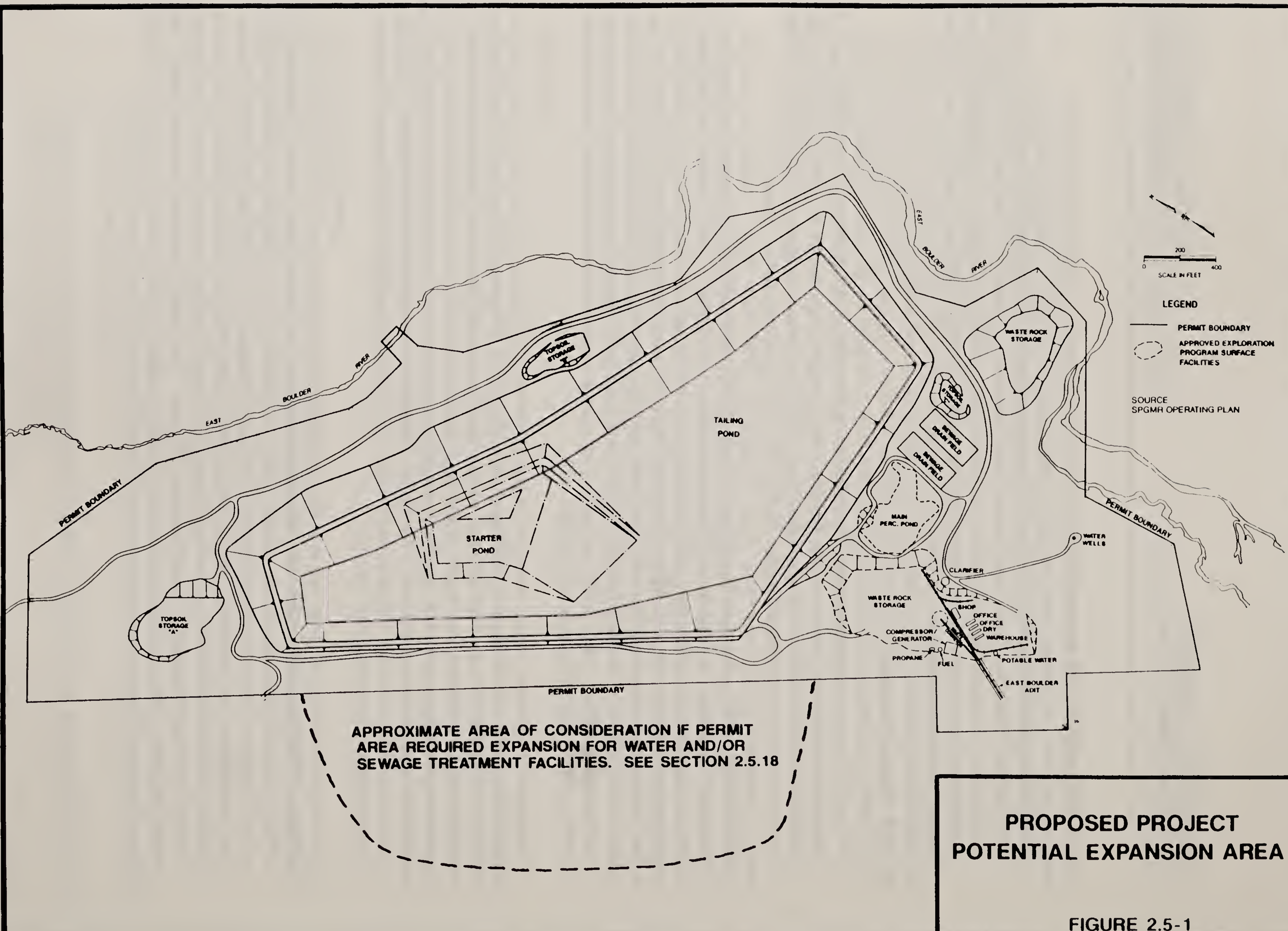
### 2.5.18 Sewage Treatment

Site-specific sewage treatment would be reviewed and approved by the State of Montana, and the development would also be approved for the site through the permit process by the USFS. Permit boundary expansion may be needed to accommodate this or other foreseeable mitigations (Figure 2.5-1). Permit boundary expansion is discussed further on page S-5 of the Summary and in Section 2.5.

A site-specific plan and design for sewage treatment, prepared by SPGMR, would be reviewed by the Montana Department of Health and Environmental Sciences (DHES). This review would include an environmental analysis of the proposed treatment. Any of a range of sewage treatment options may be appropriate at the site, but a specific system would have to be reviewed and approved by DHES for the site. The DHES review would consider site-specific soils and water data from the site, anticipated use levels, peak use, season of use and other factors. This data would be reviewed and considered in the DHES environmental analysis. After DHES approval of the sewage treatment system, the agencies could authorize construction of the facility under the permit.

In addition to the septic sewage treatment method described in SPGMR's proposed action, other treatment alternatives exist. Following is a description of a wastewater treatment system which is used in some situations. This system, and the septic system described in the proposed action, approximate the range of possible treatment systems that might work on this site. Other viable systems, or combinations of systems, exist for sewage treatment. The actual system designed for the site would likely fall in the range from the septic to the example system below. The agencies do not have an expressed preference for a particular treatment system, but would authorize construction of a facility that met DHES requirements to adequately treat sewage in accordance with State law.

One potential sewage treatment option is the construction of a treatment pond and land disposal of final effluent. Treatment pond designs vary primarily in the amount of mechanical aeration applied; increased aeration generally allows the use of a smaller pond. An example of such a wastewater treatment facility is at the U.S. Forest Service Job Corps Center in Anaconda, Montana. this facility handles 25,000 gallons per day in contrast to the predicted 15,000 gallons of sewage treated per day at East Boulder. The physical features of this facility include: and aeration lagoon, 0.75 acres; a settling pond, 0.60 acres; a holding pond, 3.0 acres; and land disposal, via spray irrigation, 5.0 acres. This facility is probably somewhat larger than would be needed a the East Boulder Mine site. A similar system at East Boulder may require 6 to 8 acres.




**PROPOSED PROJECT POTENTIAL EXPANSION AREA**

FIGURE 2.5-1

### 2.5.19 Reagents

SPGMR would be required to notify the agencies of any changes in reagents or concentrations employed in the milling process.

### 2.5.20 Cultural Resources

The access road corridor and power line corridor would potentially adversely affect sites 24SW113, 24SW223, 24SW227, 24SW231, 24SW237, and 24SW248. The mitigation treatment of these sites would depend on the kind of effect (direct or indirect) and the level of impact that the sites would be subject to. This determination would be based on the construction design as it is submitted. The treatment/mitigation plan or data recovery plan would be designed by the Forest Service, in consultation with the Montana State Historic Preservation Office and the Advisory Council on Historic Preservation (36CFR800).

### 2.5.21 Summary Table of Plans

A number of comments on the draft EIS revealed confusion over the number and types of plans SPGMR would be required to submit to the agencies for approval under Alternative 7 and when SPGMR would be required to submit the plans. Therefore, the following summary table (Table 2.5-1) has been added to the Final EIS to relieve some of the confusion. All of the following plans are included in Alternative 7. Additional detail can be found in Sections 2.5.1 through 2.5.19. Note that other mitigation measures are required in the alternative, and these plans are in addition to these measures.

## 2.6 ALTERNATIVE 8 - TWIN PRODUCTION ADITS

SPGMR has requested Alternative 8 be included so that a modification to the company's proposed action may be considered and evaluated for environmental impacts. The modification proposed by SPGMR consists of replacing the single 16-foot-diameter main East Boulder adit as described in the proposed action with two parallel 13 1/2-foot-diameter adits. Also, the Brownlee Creek adit and breakout would be eliminated. The purpose of this modification is to use the tunnel boring machine (TBM) from the Stillwater Mine in Nye, Montana, at the East Boulder Mine. This would provide the company with an alternative to the purchase of a new TBM. The Stillwater Mine TBM has a 13 1/2-foot-diameter drive as opposed to the 16-foot diameter drive included in the proposed action. The following description of Alternative 8 is based largely on information provided by SPGMR.

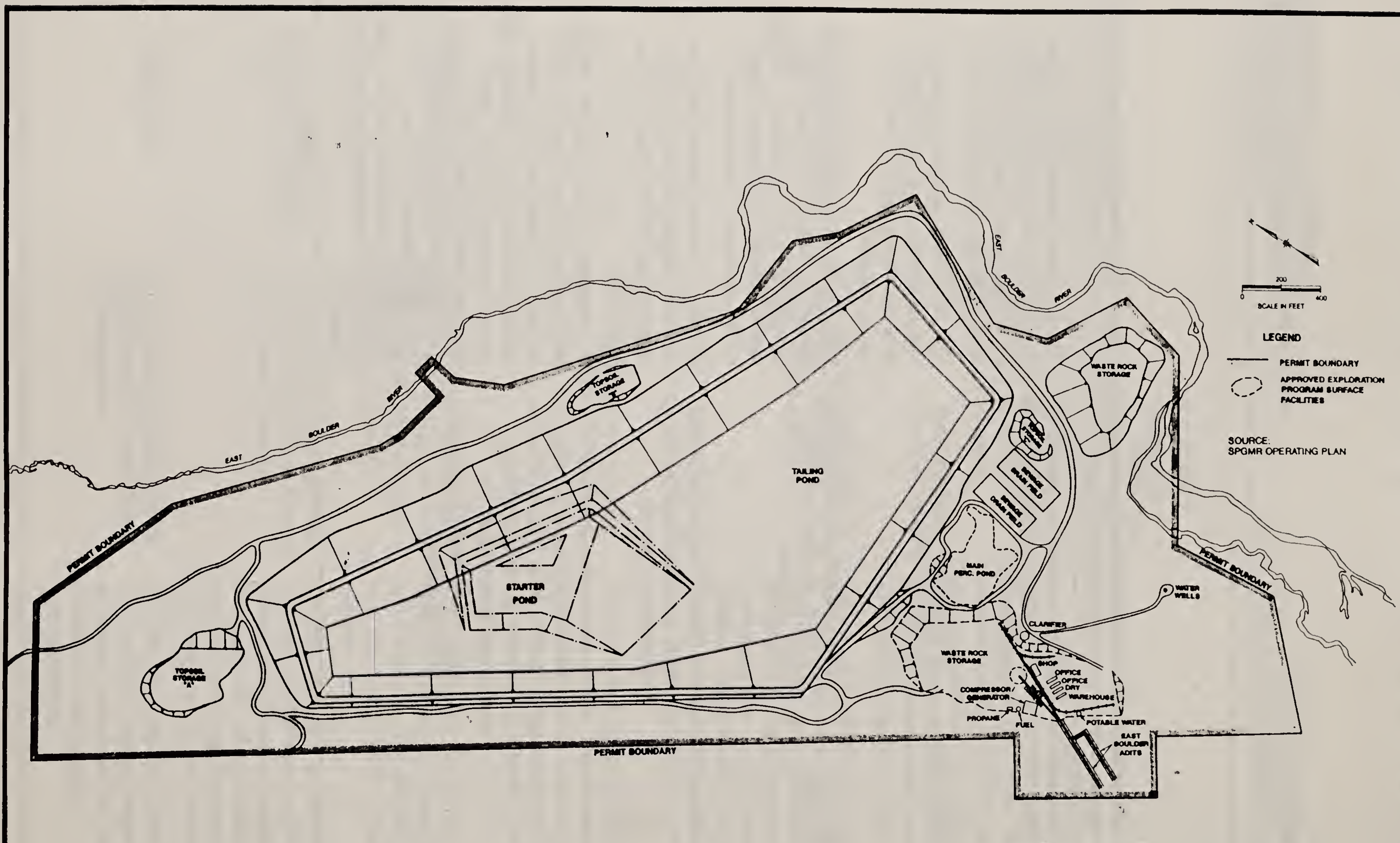
The twin adits would serve as the primary mine access. Both adits would lie within the proposed East Boulder permit area, and would occupy the proposed portal pad without the need to expand the area disturbance (Figure 2.6-1). The adits would be closely spaced (approximately 25 to 50 feet apart), and would be located adjacent to the mill and other related surface facilities. They would be sequentially driven, and have a length of approximately 18,550 feet from the surface to the intersection with the ore zone. Production cross-cuts between the adits would occur approximately every 1,000 feet.

TABLE 2.5-1
SUMMARY TABLE OF PLANS

| Plan | When Required | Explanation |
|---|---|---|
| Wildlife Monitoring Plan | To be submitted and approved by GNF and DSL before issuance of the operating permit. | Section 2.5.12.2 outlines the goals SPGMR's plan must meet. Wildlife and fisheries are included. Purpose of the plan is to monitor for impacts which could threaten sensitive species and to monitor for unanticipated detrimental impacts (e.g. toxicants in fish). |
| Water Quality/ Quantity Monitoring Plan | To be submitted and approved by GNF and DSL before issuance of the operating permit. | Section 2.5.5 outlines goals and standards SPGMR's plan must fulfill. Additional water monitoring requirements are found in Section 2.5.3 which includes a contingency plan should standards be violated. The purpose of this plan is to monitor contaminants in surface and groundwater, their sources and concentrations. |
| Wastewater Treatment Plan | To be submitted and approved by GNF, DSL & DHES prior to construction. | These are final engineering plans and specifications for specific wastewater treatment facilities. Approval is to ensure that design treatment facilities will result in water quality that meets required standards. |
| Noxious Weed Control Plan | To be submitted and approved by the Forest Service and Sweet Grass County before issuance of the operating permit. | The Jackpine EA Weed Control Plan would be updated to current locations and conditions. The purpose of this plan is to retard infestations as much as possible |
| Spill Contingency and Emergency Response Plan | To be submitted and approved by GNF & DSL before issuance of the operating permit. | The plan submitted as Appendix H to the Plan of Operations would be updated to include the information outlined in Section 2.5.16. The purpose is to have procedures in place for emergencies or spill outside the permit boundary. |
| Bussing Plan | To be submitted and approved by GNF and DSL after project implementation. | SPGMR has included a bussing plan in their proposed action; however, details on staging areas would be provided to the agencies after project implementation. |

TABLE 2.5-1
(Concluded)

| Plan | When Required | Explanation |
|---|---|---|
| Tailing Impoundment Failure Plan | To be submitted and approved after project implementation by GNF and DSL. | The plan would address impacts and mitigations to water quality fisheries, downstream users, and wildlife in the event of tailing impoundment failure. |
| Pond Maintenance Plan | To be submitted and approved by GNF and DSL at the end of mine life. | This plan would address the issue of maintaining the percolation ponds to treat mine drainage after the mine ceases operation. |
| Waste Rock Monitoring Plan | To be submitted and approved by GNF and DSL upon waste rock production. | This plan would address sampling and analysis of waste rock to assess the potential for acidic conditions. The plan should include a contingency should acidic conditions be encountered. |
| Hardrock Impact Plan | To be submitted and approved by Sweet Grass County prior to issuance of a permit. | This plan is in conformance with the Hardrock Impact Act and addresses social and economical impacts to the local county. |
| Reclamation Plan | Because reclamation is a continuing process throughout the life of the mine and beyond, various portions of this plan would be submitted for approval as deemed necessary by the agencies. | The reclamation plan SPGMR submitted with the Plan of Operations would be updated to include the requirements outlined in Section 2.5.6, including tailing impoundment reclamation. Seed mixtures would be tested throughout the life of the mine to identify the most appropriate mixture for final reclamation. Toward the end of mining operations, a dewatering plan would be submitted. |




**ALTERNATIVE 8 PROJECT FACILITIES PLAN**

**FIGURE 2.6–1**

Implementation of Alternative 8 would result in approximately 28,000 cubic yards of additional waste rock, including waste rock from the cross-cuts. This is less than a one percent increase over the estimated waste rock production described for the proposed action.

Under the proposed action, waste rock generated during normal mining activities would be used for underground construction, placed in suitable mined-out areas, or transported to the surface for disposal or use in project facility construction, tailing impoundment construction, or other development purposes. The additional waste rock generated from the second adit would be stored within the proposed waste rock storage area until it could be used for construction of the various surface facilities.

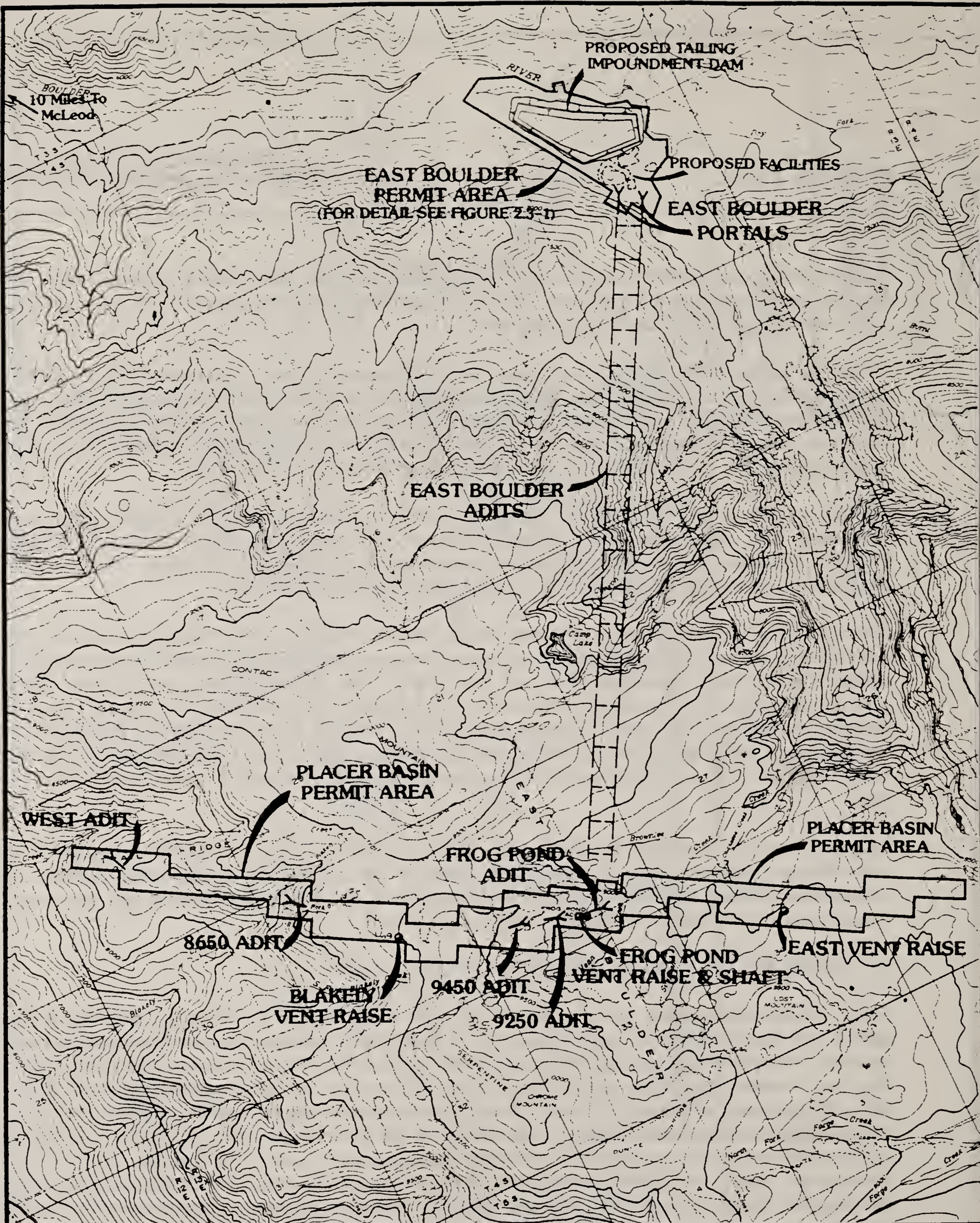
Persistent water courses encountered during adit drives would be grouted to minimize groundwater production. The overall groundwater inflow to the mine is estimated by SPGMR to be less for Alternative 8 (384 to 472 gallons per minute) than for the proposed action (500 gallons per minute). This decrease is due primarily to the elimination of the Brownlee Creek adit (Figure 2.6-2).

It is anticipated the overall power demands would decrease relative to the proposed action due to the downsizing of the tunnel boring machine. An on-site generator plant would supply power until a permanent source of power can be constructed at the site (See Section 2.4.3). The long-term source of power for the project is expected to be provided by Park Electric Cooperative. Emissions from the generator plant are predicted by SPGMR to be within the levels permitted and modeled as part of SPGMR's Exploration Air Quality Permit and proposed Production Air Quality Permit. The twin adits would replace the 5,640-foot-long Brownlee Creek tunnel, eliminating the need for the proposed yard, shelter, small generator, and heli-pad.

Alternative 8 incorporates all of the modifications and mitigations previously described in Alternative 7. The only difference between the two alternatives relates to the size of the tunnel boring machine, and consequences relating to the adit size, such as the elimination of the Brownlee Creek tunnel and probable reduction in mine discharge flow associated with Alternative 8.

## 2.7 OTHER RELATED DEVELOPMENT ACTIVITIES

Other development activities are occurring or may conceivably occur in the vicinity of the East Boulder permit area that should be reviewed because of the potential for additional or cumulative environmental impacts. In other words, certain activities may directly contribute positive or negative environmental impacts that, when considered in conjunction with impacts potentially created by implementation of the East Boulder Mine Project, lessen or increase the overall impact upon the environmental resource. These activities are termed "related development activities." The purpose of this section is to define the related development activities that need to be considered for cumulative impacts, and to provide the rationale as to why those activities are related. In addition, justification is provided fot not including other development activities in the analysis. Chapter Four of this document includes a resource-by-resource assessment of the possible cumulative impacts of the East Boulder Mine Project and specific related development activities.




LEGEND

- PERMIT BOUNDARY
- ADIT
- SHAFT
- VENT

SOURCE: U.S. FOREST SERVICE

N

0 2000 4000
SCALE IN FEET

**ALTERNATIVE 8
PROJECT
PERMIT AREA**

FIGURE 2.6-2

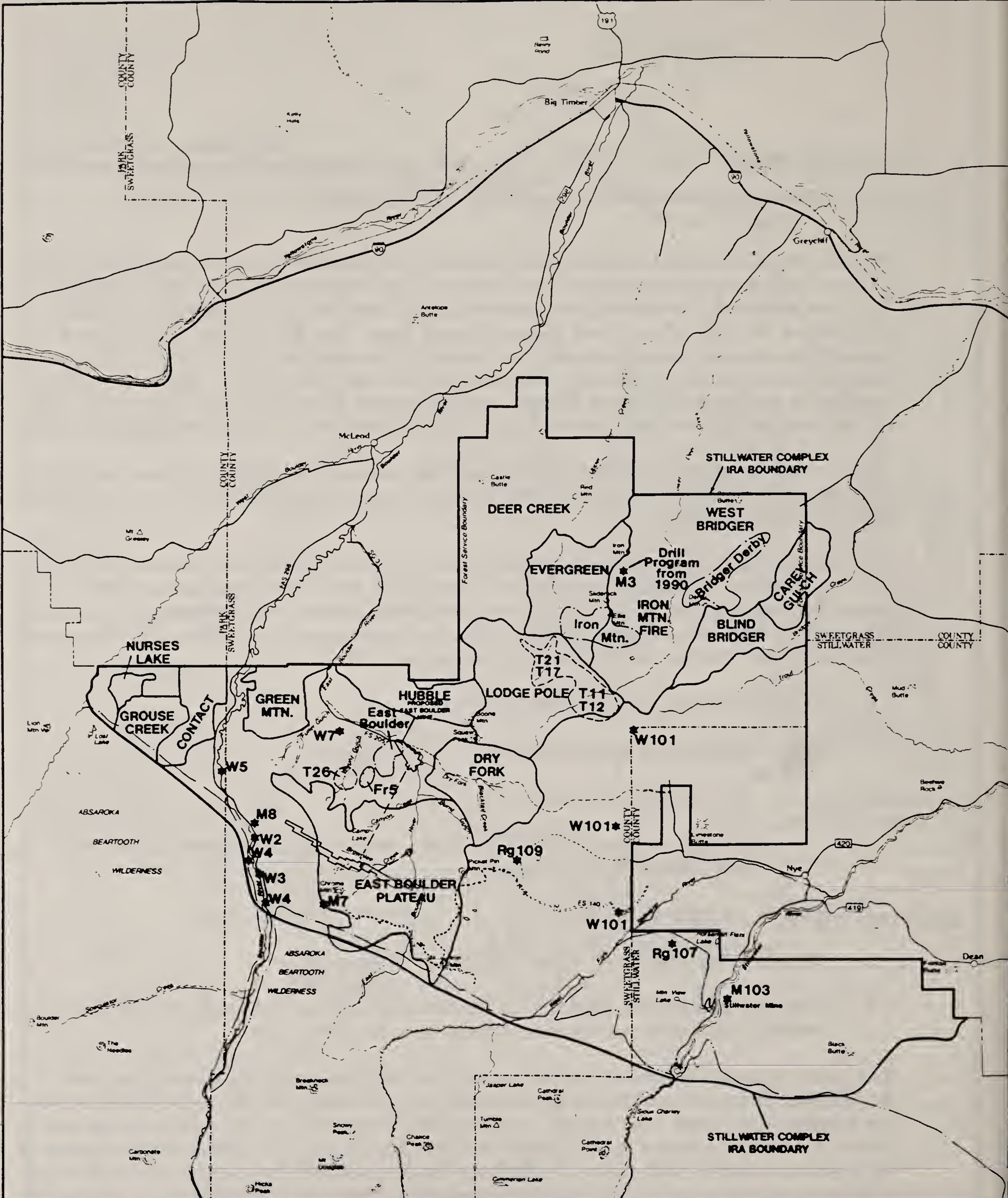
The basis for this assessment of related development activities lies within the recently completed Stillwater Complex Integrated Resource Analysis (IRA) prepared by the Gallatin and Custer National Forests. The IRA is an analysis of a geographic area, known as the Stillwater Geologic Complex, for the purpose of implementing the Gallatin and Custer National Forests' Plans. The IRA includes a discussion on how projects were assessed using a "reasonable and foreseeable" development scenario. The area in question consists of approximately 193,243 acres in south-central Montana (Figure 2.7-1). It includes such major drainages as the East Boulder, Main Boulder, and West Boulder Rivers; Upper and Lower Deer Creeks; and the West Fork Stillwater and Stillwater Rivers, all of which feed into the Yellowstone River to the north.

The study area encompasses the Stillwater, Natural Bridge, and Deer Creek Mining Districts, and portions of the Independence and Nye Mining Districts. The study area is bordered on the south by the Absaroka-Beartooth Wilderness Area.

The location of the proposed East Boulder Mine Project is within the boundaries of the Stillwater IRA, and therefore the document was used as a guide to determine and assess other development activities. As a means of determining which activities or potential development activities in the Stillwater Complex should be evaluated a review was conducted of all the Projects of Concern studied in the IRA. The IRA projects of concern include activities that have met the following four criteria:

1. Projects which may have an impact in terms of:
    - Knowledge of issues and concerns
    - Past experience with similar projects
    - Overall consequences, and therefore require an Environmental Assessment or Environmental Impact Statement
2. Projects causing earth disturbance
3. Projects having major issues or concerns
4. Projects required by law, regulation, or direction to be analyzed, such as those having an effect on roadless classification or threatened, endangered, or sensitive species

Each project of concern was evaluated to determine if it had environmental consequences related to the East Boulder Mine Project in terms of geographical impact area. An initial list of related development activities was prepared by reviewing those projects of concern which are occurring or may occur in habitat used by wildlife that could be impacted by the East Boulder Mine Project. Figure 2.7-1 illustrates the locations of the projects of concerns, while Figure 2.7-2 illustrates the projected time lines for each project of concern. Wildlife was selected as an "indicator" resource because of the wide ranging migration routes and range for species such as elk and deer. In other words, more projects of concern will be evaluated for impacts on wildlife than for any other resources because of the potential impacts for such a large geographical area.




**LEGEND**

- * PROJECTS OF CONCERN (See Text For Description)
- (HUBBLE) RANGE ALLOTMENT
- EXISTING TIMBER SALE
- PROPOSED TIMBER SALE

SOURCE: GALLATIN NATIONAL FOREST

**RELATED DEVELOPMENT ACTIVITIES**

**FIGURE 2.7-1**

## Other Development Activities

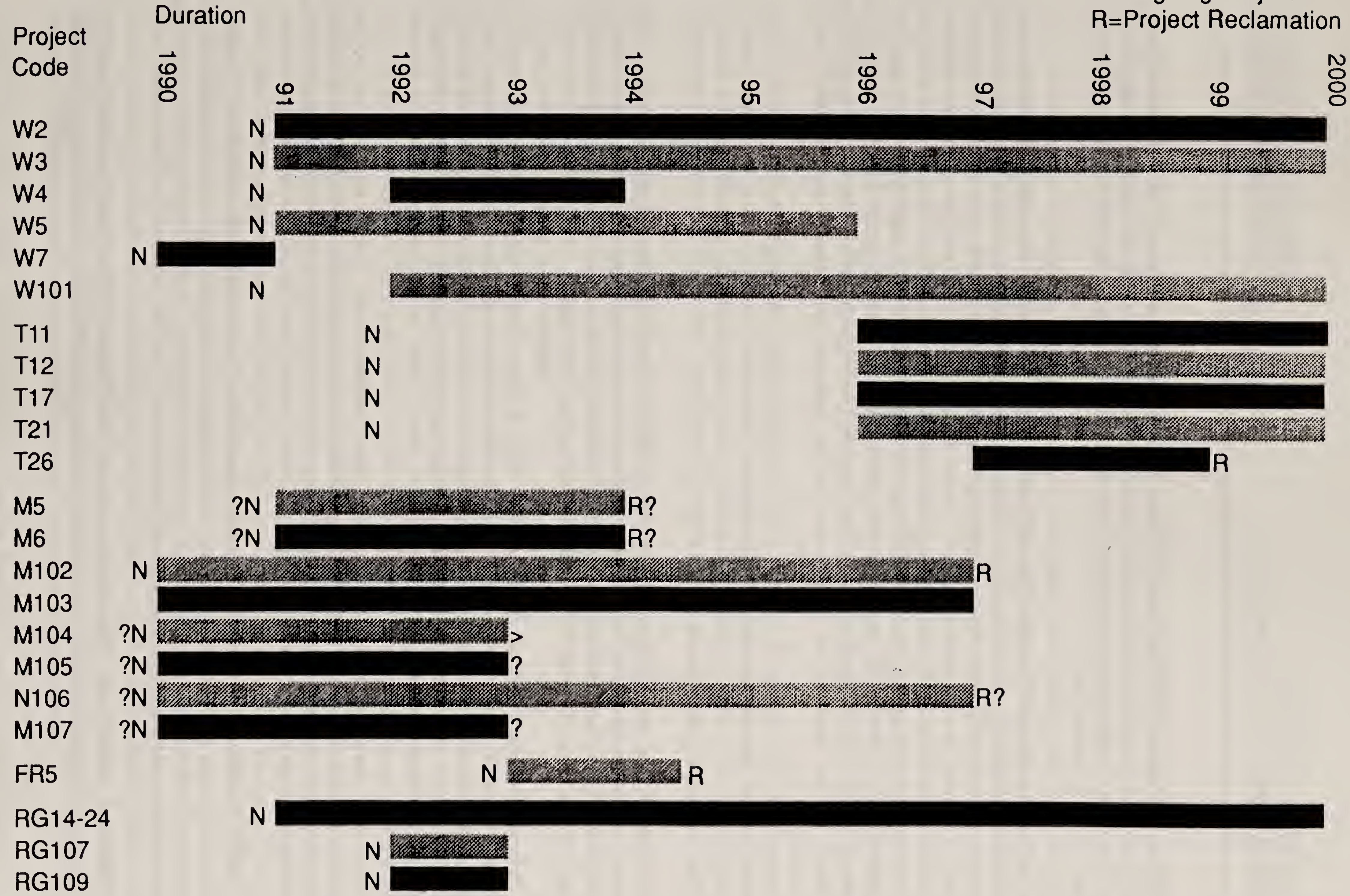



FIGURE 2.7-2

The following sections identify projects of concern that may impact wildlife and other resources that could also be affected by the East Boulder Mine Project. The resources that may be impacted by the project are listed in bold after each project description. (A more detailed description of each project of concern is included in the Stillwater IRA.)

Most environmental resources need to consider a much smaller geographical area than wildlife; for instance, concerns about cumulative effects to surface and groundwaters are limited to related development activities located within the East Boulder River drainage system. Therefore, wildlife is by far the most prevalent resource of concern for the following projects. Most of the projects considered for cumulative effects have not yet been initiated but are projected to begin sometime before the year 2000. Other projects have already been initiated and are ongoing. However, it should be understood that some activities in the vicinity of the East Boulder Mine Project are not considered for cumulative effects because they have already been completed. These include the East Boulder timber sale, Lewis Gulch timber sale, and exploration at the Nye Mine. Further impacts from these projects are not expected and evaluation for cumulative effects is not necessary.

**2.7.1 Projects of Concern Evaluated in this EIS**

The following projects would occur on the GNF.

**W2[**] - Aspen Habitat Improvement - Main Boulder River:** Annual treatment project to improve about two 3-acre stands of aspen; includes cutting of clones, fire treatment to initiate suckering and rejuvenation, and temporary fencing until clones are established. This project is included because of its impact on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife.**

**W3 - Browse Production Habitat Improvement - Main Boulder River:** This project would create small openings in lodgepole pine timber stands to increase browse production for wintering elk/deer, increase biological diversity, create fire breaks, and provide local economic opportunity through small post and pole sales. This project is included because of its impact on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife.**

**W4 - Prescribed Burning Habitat Improvement - Main Boulder River:** Habitat improvement by the use of prescribed burns on the west side of the Main Boulder River across from Clydehurst and at the mouth of West Chippy Creek. This project is included because of its impact on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife.**

**W5 - Beaver Reintroduction Project - Main Boulder River:** This project will evaluate the potential for reintroducing beaver into the Main Boulder River drainage including the East and West Boulder Rivers. This project is included because of its impact on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife, water quality, wetlands, vegetation.**

**W7 - Mule Deer Winter Range Habitat Improvement - East Boulder:** Creation of scattered, small 1- to 5-acre openings to increase browse production for wintering mule deer and increase biological diversity for

[**] The alpha-numeric codes, for example W2, W3, T11, are provided to allow cross-reference with the Stillwater IRA.

other non-game wildlife in continuous, undiversified, relatively unproductive stands of "doghair" Douglas-fir and lodgepole pine in East Boulder Management Area 11. This project is included because of its impact on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife.**

**T11 - Identification of Stands for Timber Harvest - Lower Deer Creek Timber Sale:** Selection process for timber harvests in Lower Deer Creek. Approximately 300 to 400 acres will be analyzed for timber harvest potential to be initiated in January, 1991. This project is included because of its potential impact on elk, deer, and possibly black bear habitat, species that may be impacted by the East Boulder Mine Project. **Wildlife.**

**T12 - Commercial Firewood Sales - Lower Deer Creek Timber Sale:** Consideration will be given to offering additional firewood sales in the extensive blowdown areas of Lower Deer Creek. These would benefit wildlife and help to meet fuel management objectives. This project is included for the same reasoning as T11. **Wildlife.**

**T17 - Identification of Stands for Timber Harvest - Lower Deer Creek Timber Sale (Upper Deer Creek):** Subsequent to old growth stand verification and identification of structure of stands, stands in Upper Deer Creek will be identified for potential timber harvest. Includes approximately 100-200 acres for timber harvest proposal to be initiated January 1991. This project is included for the same reasoning as T11. **Wildlife.**

**T21 - Identification of Stands for Timber Harvest - Lower Deer Creek Timber Sale (West Fork of Upper Deer Creek):** Subsequent to old growth stand verification and identification of structure of stands, stands in Compartment 110 (W. Fork of Upper Deer Creek) will be identified for potential harvest. Includes approximately 168 acres for timber harvest proposal to be initiated January 1991. This project is included for the same reasoning as T11. **Wildlife.**

**T26 - Identification of Stands for Timber Harvest - Wright-Gulch Timber Sale:** Subsequent to old growth stand verification, HEI, and structure, stands available for timber harvest in Management Area 8 can be identified. Approximately 168 acres will be analyzed for timber harvest proposal. This project is included because of its potential impacts on water quality; habitat for elk, mule deer, black bear, and pine martin; and old growth forest, and their relationship to the East Boulder Mine Project impacts. **Wildlife.**

**M5 - Pegasus Explorational Drilling, Independence:** Few details are available, but it is assumed drilling for minerals exploration would occur sometime between 1990 and 1995, with associated NEPA compliance and reclamation. Because of the potential impacts on water quality, recreational opportunity, and socioeconomic and other resources impacts including wildlife, this project is included for review. This project is outside the IRA boundary and not mapped, but it is similar enough to consider in this analysis. **Wildlife, mineral resources, surface water, recreation, socioeconomics.**

**M6 - Pathfinder Explorational Drilling, Independence:** Few details are available, but it is assumed drilling for minerals exploration would occur sometime between 1990 and 1995, with associated NEPA compliance and reclamation. Because of similar potential impacts as stated in M5, this project is included for review. This project is outside the IRA boundary and not mapped, but it is similar enough to consider in this analysis. **Wildlife, mineral resources, surface water, recreation, socioeconomics.**

**M7 - Whittaker Exploration Permit, East Chippy Creek:** Exploration was conducted in 1990. Further activity is unknown at this time, but it is assumed a drilling program would occur sometime between 1990 and 1995, with associated NEPA compliance and reclamation. Because of similar potential impacts as stated in M5, this project is included for review. **Wildlife, mineral resources, surface water, recreation, socioeconomics.**

**M8 - Interwest Exploration Permit, Graham Creek:** Exploration was conducted in 1990. Further activity is unknown at this time, but it is assumed a drilling program would occur sometime between 1990 and 1995, with associated NEPA compliance and reclamation. Because of similar potential impacts as stated in M5, this project is included for review. **Wildlife, mineral resources, surface water, recreation, socioeconomics.**

**Fr5 - Snowdown Fuels Hazard Reduction:** Reduction of fuels in approximately 100 acres located along existing East Boulder River Road. This project is included for the same reason as T26, Wright-Gulch Timber Sale. **Wildlife.**

**Rg14-24 - Range Improvement Burns:** Conifer encroachment will be evaluated during update of allotment management plans and treated with prescribed fire if possible. All burning will be integrated with wildlife, timber, and other resource needs. This project is included for its impact on wildlife that may also be affected by the East Boulder Mine Project. These projects are not mapped because they cover the entire area, and site-specific locations are not identified. **Wildlife.**

**Rg33-39 - Noxious Weed Control:** This project incorporates all annual treatment for known infestations of noxious weeds including spotted knapweed, leafy spurge, and Canadian thistle within the Stillwater Complex. Within the East Boulder River valley, less than 1 acre each of leafy spurge and spotted knapweed are known to occur. Approximately 20 acres of Canadian thistle are present in the area of the East Boulder timber sale. Spot spraying by plant of the Canadian thistle will occur in 1993 and 1995. Leafy spurge and spotted knapweed will be controlled as they occur through a plant-specific spraying program and conducted according to the final EIS for the GNF Noxious Weed Control Program (1980, updated annually). Weed control will be considered in the cumulative effects analysis because of the threat the chemicals used can present to area groundwater. These projects are not mapped because they cover the entire area, and site-specific locations are not identified. **Surface water, groundwater, vegetation, wildlife.**

**Iron Mountain Fire Salvage Sale:** Temporary roads are being constructed for a potential salvage sale of approximately 100 acres of standing burned timber. This project is included for its potential impacts on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife.**

### 2.7.2 Projects of Concern Evaluated in this EIS

On the Custer National Forest the following projects would occur.

**W101 - Aspen Management:** Aspen regeneration projects for wildlife habitat improvements in the Picket Pin Allotment (NE Section 3 and NE Section 2, T5S, R14E), Pass Creek Allotment (SE Section 19, T4S, R15E and NE Section 24, T4S, R14E), and Lodgepole Allotment (NW Section 1, T4S, R14E and SW Section 6, T4S, R15E). These projects are included because of their impact on wildlife that may also be affected by the East Boulder Mine Project. **Wildlife.**

**Rg107 - Horseman Flat Conifer Treatment:** Prescribed fire, post and pole sales, and/or firewood collection will be used to treat approximately 200 acres of conifer encroachment in the Horseman Flat allotment, Section 9, T5S, R15E. Because of the potential impacts on wildlife that may also be affected by the East Boulder Mine Project, this project is included for analysis. **Wildlife.**

**Rg109 - Picket Pin Meadow Improvement:** Fertilization and herbicide treatment of 60 acres to renovate meadows in the Picket Pin Allotment, Sections 29, 33, 22, T5S, R14E. Because of the potential impacts on wildlife, groundwater quality, and surface water quality, this project is included for analysis. **Wildlife, water quality, vegetation.**

**Stillwater Plateau Minerals Exploration, Mining and/or Processing Projects, Including:**
**M102 - International Platinum-Picket Pin Project**
**M103 - Stillwater Mining Company-Stillwater Mine Project - Project 2000**
**M104 - Chrome Corporation of America-Mountain View/Mouat Mine**
**M105 - Stillwater PGM Resources Exploration**
**M106 - Chrome Corporation of America - Crescent Creek/Iron Mtn Project**
**M107 - Hjelvik Bluebird Claim Group Evaluation**
6lateau mining, minerals processing, and/or exploration projects are considered related development activities because of potential impacts to wildlife, recreational activities, socioeconomic patterns, and other environmental resources consequences. **Wildlife, recreation, socioeconomics, wilderness.**

**2.7.3 Projects of Concern not Evaluated in this EIS**

The following GNF projects have not been included in the cumulative impact analysis.

**Fi1 - Yellowstone Cutthroat Reintroduction - Lower Deer Creek:** Verified, genetically-pure Yellowstone Cutthroat trout were found in Lower Deer Creek above the forest boundary. Above a natural falls, the MDFWP found the stream was barren of fish yet it has good to excellent fish habitat. Evaluation and implementation of an introduction program constitutes this project. However, because the project occurs in a drainage not connected directly to the East Boulder River drainage, it is not evaluated for cumulative impacts.

**Te1 - Peregrine Falcon Hack Site:** A reintroduction project to establish peregrine falcons into historic habitats. This project is being evaluated as a separate related action and, therefore, is not assessed for cumulative effects.

**T2 - Small Timber Sale, Overstory Removal:** Approximately 92 acres on 7 stands in subcompartments 107-01 and 107-04, of which approximately 10 acres with an average of 2 thousand board feet/acre will be available. This project is outside the normal range of East Boulder River wildlife and would contribute no other environmental impacts relevant to the East Boulder Mine Project, so it is not assessed for cumulative effects.

**T3 - Overstory Removal of Shelterwood Units:** Approximately 125 acres within stands included in the current Bridger/Derby Sale will undergo overstory removal when deemed necessary by Forest Service silviculturist, for a total of approximately 250 MBF. This project is outside the normal range of East Boulder

River wildlife and would contribute no other environmental impacts relevant to the East Boulder Mine Project, so it is not assessed for cumulative effects.

**M3 - Cominco American Explorational Drilling:** Cominco has completed exploratory drilling in the Gold Hill area. However, because the drilling program would be conducted only during summer months no impacts to East Boulder wildlife, which use this area for winter range, would occur. The project would contribute no other environmental impacts relevant to the East Boulder Mine Project, so it is not assessed for cumulative effects.

**M4 - Miniear Placer Operation:** A "hobby" placer mining operation in the Independence area. This project is considered too small to contribute measurable environmental impacts and will, therefore, not be assessed in this EIS for cumulative effects.

**Rg13 - Allotment Management Plan (AMP) Revisions:** This includes updating AMPs throughout the decade based on known or suspected problems. All AMPs will be in compliance with the Forest Plan standards at the time of Term Permit reissuance. However, AMP revisions will be conducted as a result of other environmental consequences; the revision itself is not predictable and does not of itself cause positive or negative impacts. Therefore, it is not considered in this EIS for cumulative impacts.

### 2.7.4 Projects of Concern not Evaluated in this EIS

The following Custer National Forest projects have not been included in the cumulative impact analysis.

**W110 - Bad Canyon Vegetation Analysis:** Development of a vegetation management plan for the Bad Canyon analysis area; no commercial timber sales are anticipated as a result of this effort. This project will create no environmental impacts to be related to the East Boulder Mine Project, and is therefore not evaluated in this EIS.

**W111 - Lodgepole Creek/Picket Pin Creek Vegetation Management Analysis:** Development of a vegetation analysis for the Lodgepole Creek/Picket Pin Creek area. This project is not evaluated in the EIS for the same justification as W110.

**W112 - Fishtail Creek/Fiddler Creek Vegetation Management Analysis:** Development of a vegetation analysis for the Fishtail Creek/Fiddler Creek area. This project is not evaluated in the EIS for the same justification as W110.

**Allotment Management Plan (AMP) Revisions:** This includes updating AMPs throughout the decade based on known or suspected problems. All AMPs will be in compliance with the Forest Plan standards at the time of Term Permit reissuance. The following AMPs are anticipated for revision: Rg 102, Bad Canyon; Rg 111, Little Rocky; Rg 112, West Fishtail; and Rg 113, Sheep Creek. AMP revisions will be conducted as a result of other environmental consequences; the revision itself is not predictable and does not of itself cause positive or negative impacts. Therefore, the AMP revisions are not considered in this EIS for cumulative impacts.

**Rg106 - Horseman Flat Range Improvement:** Construction of approximately 3/4 mile of livestock water pipeline and 1/2 mile of pasture division fence in Horseman Flat allotment N1/2, Section 8, T5S, R15E.

This project would have not environmental impacts related to the East Boulder Mine Project, and is therefore not evaluated for cumulative effects in this EIS.

**Nx101 - Noxious Weed Control:** Continued annual treatment of known infestations of noxious weeds within the Custer portion of the Stillwater IRA boundaries. This ongoing project is not considered for cumulative impacts because of the remoteness of the project relative to the East Boulder Mine Project.

**M101 - Chrome Corporation of America Benbow Project:** Continued chrome ore exploration and evaluation that makes use of the access route from Dean to the Benbow mine, with approximate surface disturbance of 1/2 acre/year, or two acres through the duration of the project. This project would not have environmental impacts related to the East Boulder Mine Project, both because of its remoteness from the East Boulder Mine location and the relatively small area of disturbance. Therefore, it is not considered for cumulative impacts in this EIS.

**Rc102 - Road Access to Limestone Butte/Bad Canyon Area:** This project contemplates road access development to tie in with the existing trail system at the south end of the management area. Two different options are being considered. Because of its remoteness from the East Boulder Mine location, the project is not considered for cumulative impacts in this EIS.

**Rc104 - Stillwater Overlook:** Development of a trail and overlook in the area of Old Nye Picnic area, anticipated for 1993. Day hiking opportunities and access to Horseman Flats Lake for fishing. Due to its remoteness from the East Boulder Mine location and small area of disturbance, this project is not considered for cumulative impacts in this EIS.

**Rc105 - Trailhead Parking at Lodgepole Road and Lodgepole/Dead Indian Creek Trails:** If public access is acquired on the Lodgepole road, a trailhead parking facility will be needed at the junction of Lodgepole road and the Lodgepole and Dead Indian Creek trail systems. This project is not evaluated in this EIS for the same justification as RC104.

**Rc106 - Trailhead and Washburn Trail Reconstruction:** Consists of improvements to the road through the Meyers Creek Station, development of a dispersed camping/trailhead facility, and reroute of the Washburn trail around the Washburn homestead. This project is not evaluated in this EIS for the same justification as Rc104.

**Rc107 - Pass Creek Trail:** The public access right-of-way will be located through private land and the trail will be rerouted as needed for safety reasons. In addition, the remainder of the trail will be reconstructed. This project is not evaluated in this EIS for the same justification as Rc104.

**Rc108 - Initial Creek Campground:** Anticipates construction of a 20 to 30 unit campground in the Initial Creek drainage to provide dispersed recreation opportunities. This project is not evaluated in this EIS for the same justification as Rc104.

**Rc109 - Offroad Vehicle Area:** This project involves development of a trail system for motorcycles and snowmobiles. Included will be trailhead parking. The estimated development schedule for the project is

1996; however, the area of impact for this project has not yet been determined, and therefore no assessment of cumulative effect with the East Boulder Mine Project can be made.

**Rc110 - Trailhead and Reroute of Benbow Trail #51:** A trailhead for the popular Benbow trail will be constructed and some rerouting will take place to provide access to Mt. Hague and Mt. Wood. Estimated construction will begin in 1996. This project is not evaluated for cumulative impact in this EIS for the same reasoning as Rc104.

**Rc111 - Woodbine Campground Reconstruction:** Modernization and increased capacity of the Woodbine Campground. Road and spur paving to reduce impacts on watersheds. Impacts on watershed are not related to the East Boulder River drainage, and increased recreational opportunities resulting from the improvements are not so great as to warrant evaluation of cumulative impacts with the East Boulder Mine Project.

**Rc112 - Construction of Woodbine Falls Trail Trailhead:** Development of a trailhead on the second most "utilized" trail in the district. Trailhead with parking facilities separate from the campground will be created in conjunction with the campground modernization program. This project is not evaluated for cumulative impacts for the same reasoning as presented in Rc111.

**Lands Acquisition or Exchange:** Acquisition of additional FS lands is proposed in the following projects: L101, Limestone/BLM Exchange; L102, Lodgepole Creek Exchange; and L103, Stillwater River Area Small Tracts Act or Exchange. These projects will not have impacts great enough to warrant evaluation for cumulative effects in this EIS.

## 2.8 AGENCIES' PREFERRED ALTERNATIVES

The agencies' preferred alternative for the proposed East Boulder Mine is Alternative 8, Twin Production Adits. The road route preferred by the agencies is Alternative 2, which is the existing route (RI) (SG31 and FS205). The existing route is preferred because the agencies do not have the authority to enforce use of a particular public road. Therefore, development of a new road would potentially increase the environmental impacts and provide no guarantee that SPGMR would not use the existing route. The preferred powerline alternative for the delivery of power to the Duck Creek Tap is Alternative 5A (Power Corridor 1).

The agencies' analysis of treatment options presented in Chapter 4 indicates that, even with advanced treatment, some degradation of ground and surface water will occur. The agencies' preferred water treatment alternative is based on provisions of the Water Quality Act (WQA), including protection of uses (75-5-101, MCA) and Nondegradation Policy (75-5-303, MCA). The WQA allows the Board of Health and Environmental Sciences (BHES) to authorize degradation only after treatment of wastes; a demonstration of economic or social need; and a demonstration that any change in quality will not preclude present and anticipated beneficial uses.

It is the judgement of the Department, based on current information, that the inorganic nitrogen concentration should not exceed 1.0 mg/l in the East Boulder River. This concentration is based on ARM 16.20.633(1)(e), which prohibits discharges which produce undesirable aquatic life. Thus, beneficial uses of surface water would not be impaired.

Efficient use of conventional treatment technologies would effectively remove particulate solids and associated metals, with the exception of manganese, and maintain existing water quality in the East Boulder River. However, granting the requested increase in the petition would not impair beneficial uses.

The agencies believe that beneficial uses of groundwater would not be impaired if the Board were to grant SPGMR's petition for 8 mg/l. The current available data indicates that concentrations above 2.7 mg/l in the groundwater may result in surface water concentrations above 1 mg/l nitrogen, based on the assumption that all nitrogen enters surface water below the mine site. SPGMR would be required to submit final plans and specifications of all water treatment facilities to the agencies, demonstrating how the concentrations authorized by the Board would be achieved in both surface and groundwater.

The agencies' preferred alternative is a level of treatment equivalent to Alternatives 6a or 6b (Table 2.8-1). This level of treatment will ensure that all present and anticipated uses of surface and groundwater are protected.

The Record of Decision (ROD) will be prepared by the agencies, following the Board's hearing in which the petition is acted upon. The findings of the Board will be considered in developing the ROD.

TABLE 2.8-1

COMPARISON OF WATER TREATMENT ALTERNATIVE ACHIEVING ALLOWABLE CONCENTRATIONS

| Parameter | Existing Water Quality | SPGMR Requested Concentration | Applicable Standard | Maximum Allowable Concentration[1] | Alternatives Achieving Allowable Concentration[4] |
|---|---|---|---|---|---|
| Surface Water | | | | | |
| TDS | 100 | 200 | 250 | 200 | 2, 6a, 6b, 6c |
| Nitrate + Nitrite[2] | 0.09 | 5 | Inorganic Nitrogen 1.0 mg/l | Inorganic Nitrogen 1.0 mg/l | 6a, 6b |
| Ammonia[2] | <.11 | 0.4 | | | 6a, 6b |
| Chromium[3] | <.005 | 0.005 | 0.011 | 0.005 | 2, 6a, 6b, 6c |
| Iron[3] | 0.052 | 0.2 | 0.3 | 0.2 | 2, 6a, 6b, 6c |
| Manganese | <.012 | 0.03 | 0.05 | 0.03 | 6a, 6b, 6c |
| Lead[3,6] | <.021 | 0.003 | 0.0024 | .0024 | 2, 6a, 6b, 6c |
| Groundwater[5] | | | | | |
| Nitrate | 0.1 | 8 | 10 | 8 | 2, 6a, 6b, 6c |
| Chromium[3] | <.02 | 0.02 | 0.05 | 0.02 | 2, 6a, 6b, 6c |

1. Maximum allowable concentration (mg/l), based on protection of beneficial uses or SPGMR requested concentration, whichever is more restrictive.
2. Inorganic nitrogen in the East Boulder River not to exceed 1.0 mg/l and ammonia not to exceed 0.4 mg/l, based on protection of aquatic life.
3. The agencies' analysis of baseline information indicates that conventional treatment of effluent will reduce the concentration of iron, chromium, and lead to below existing water quality.
4. Alternatives 3, 4, 5, 7, and 8 would be selected in combination with BHES determination of ambient levels. Alternative 1, No Action, would maintain existing water quality.
5. TDS, ammonia, iron, and manganese are not subject to the nondegradation requirement in groundwater. Because lead concentrations are below ambient levels, SPGMR has not petitioned for a modification.
6. Lead concentrations are a function of hardness. Criteria are based on average total hardness of 80 mg/l. SPGMR request is based on total hardness of 100 mg/l. Ambient hardness varies between 20-110 mg/l (see Chapter 3).

An analysis of the potential environmental impacts caused by SPGMR's proposed mine in the East Boulder River valley necessitates an understanding of the current status of the environment. To facilitate this understanding a review of current conditions has been` conducted which addresses fifteen separate environmental resources or disciplines. Together these topics encompass the universe of social, economic, and natural resources which may be part of the "affected environment" for this project.

The selection of EIS topics was governed by Department of State Lands (DSL) and Gallatin National Forest (GNF) insight into the proposed mine project, and expressed public concerns, as voiced through letters to the regulatory agencies and citizen comment at public meetings. Resource specialists from DSL, GNF, and the EIS consultants developed an overall description of the current environmental condition for each of the 15 resources. In addition, they identified issues within each topic which could be affected, directly or indirectly, by the project as proposed by SPGMR. These potential affects are examined more closely in Chapter Four.

The proposed location of SPGMR's mine facilities is within the East Boulder River valley drainage, approximately 30 miles south of Big Timber, Montana (See Figure 1.1-1). The surrounding area is mountainous, relatively sparsely populated, and noted for its scenic beauty and recreational opportunities such as hunting, fishing and hiking. Designated wilderness areas are located nearby and Yellowstone National Park is approximately 30 air miles from the Placer Basin proposed adit location, although road access to the Park requires a drive of approximately 90 miles from the proposed project area.

An important function of this EIS is to evaluate alternatives developed to reduce or eliminate degradation of groundwater and surface waters in the vicinity of the mine and mill facilities. Montana groundwater pollution control for mining projects occurs through conditions contained in the operating permit. Discharges to surface waters and groundwater for this project would contain compounds such as iron and nitrates at concentrations greater than existing water quality and would, therefore, require a modification of ambient quality under the Montana nondegradation rules. This EIS will provide the analysis required by the Board of Health and Environmental Sciences to make an informed decision whether to grant a modification of ambient conditions or to require implementation of methods designed to prevent water degradation.

The project area is located within the boundaries of the Big Timber District of the Gallatin National Forest. GNF has developed a Forest Plan which is designed to guide all natural resource management activities within the Forest, and which establishes management standards for the Forest. A forest-wide standard particularly relevant to this project in the Forest Plan recognizes existing and future rights to prospect, develop, and mine in the GNF. The Forest Plan also contains a number of goals for the Forest, which include provisions for "orderly and environmentally sound exploration and development of minerals, oil and gas, and geothermal resources." Another important function of this EIS is, therefore, to evaluate the East Boulder Mine application for ability to achieve the Forest standards and conformance with stated objectives for each management area.

This document tiers to the Final EIS and Forest Plan for the GNF, September, 1987. The following is a short synopsis of the standards and guidelines established in the Forest Plan that are pertinent to this action. Direction for this action occurs primarily in the Forest Plan sections on goals (FP, pp. II-1 to II-2), objectives (FP, pp. II-2 to II-7), standards (FP, pp. II-14 to II-29), and management area direction (FP, pp III-1 to II-73).

Forest-Wide Goals, Objectives, and Standards:

Recreation - Provide for a broad spectrum of recreation opportunities. Manage roads and trails to be responsive to resource needs (FP, pp. II-1).

Visual Quality - Provide visitors with visually appealing scenery (FP. pp. II-1).

Wildlife - Provide habitat for all indigenous wildlife species, increasing populations of big game species, and recovered populations of threatened and endangered species (FP, pp. II-1). Manage big game winter range by meeting cover and forage requirements (FP, pp. II-18). Sufficient snags, down, and dead material will remain in harvest units to maintain habitat requirements of cavity dependent species (FP, PP. II-18 and A-13).

Fish and Water Quality - Best Management Practices (BMP) will be used to mitigate the impact of ground disturbing activities to streams and water courses (FP, pp. II-4). State Water Quality Standards will be maintained to provide for an increased fish population (FP, pp. II-1).

Timber - Suitable timber lands will be managed for improved productivity and a sustained yield of timber products (FP, pp. II-1). Forest lands within the suitable base will be managed for a diversity of age and size classes. A minimum of ten percent of a compartment will be maintained in each of six successional stages (FP, pp. II-20): grass-forb, seedlings, saplings, poles, mature, and old growth.

Soils - Watersheds will be managed by application of "Best Management Practices." Management standards have been set to mitigate impacts occurring to the watershed resource from land use activities (FP, pp. II-5).

Wildlife - Management of wildlife habitat will emphasize forage and cover needs on big game winter range. Non-game and small game needs will be enhanced by providing for vegetative diversity and protecting special habitat components. Adequate security for elk will be maintained over time by providing hiding cover and road management (FP, pp. II-3-4).

Minerals - Existing and future rights to prospect, develop, and mine on National Forest lands open to mineral entry will be recognized in implementation of the Forest Plan. Management Area and Forest-wide standards will be considered in the development of the Plan of Operations and/or in the approval of the Notice of Intent (FP, pp. II-5-6).

The GNF Plan subdivided the Forest into twenty-six management areas. These areas are described in detail in Chapter 3 of the Forest Plan (FP, pp. III-2 to III-73). The following Management Areas occur within or near the project area:

Management Area 1 (MAI) - These are areas already developed for human activity and include campgrounds, picnic areas, etc. as well as sites suitable for potential development. These areas are managed for safety and enjoyment of users, and to provide additional facilities where needed.

Management Area 3 (MA 3) - These are areas which are non-forest, noncommercial forest, or generally unsuitable for timber production. They are principally undeveloped with few roads or improvements. Topographic features often limit development.

Management Area 6 (MA 6) - Generally these are areas with large blocks of undeveloped land having trails or a few roads running through them. These areas are to be managed for a wide variety of dispersed recreational opportunities. Lands within this management area are unsuitable for timber harvest.

Management Area 7 (MA 7) - These include riparian zones; areas where transported water provides soil moisture in excess of what is available to support a moist vegetation regime. Lands within this management area are suitable for timber harvest as long as soil, water, vegetation, fish, and dependent wildlife species are protected and are adjacent to areas suitable for timber management.

Management Area 8 (MA 8) - These are areas which are suitable for timber management. Lands within this area are managed to provide for productive timber stands and optimize timber growing potential. Areas will be managed to develop an equal distribution of age classes, optimize sustained timber production, and improve vegetative diversity.

Management Area 11 (MA 11) - These areas consist of forested big game habitat. They include productive forest lands available for timber harvest, provided that big game habitat objectives can be met.

Management Area 12 (MA 12) -These areas provide important summer or winter wildlife habitat. Lands within this area are managed to maintain or improve vegetative conditions for wildlife and provide for a variety of dispersed recreation opportunities. These lands are unsuitable for timber management.

Management Area 16 (MA 16) - These are open grasslands interspersed with non-productive timber lands. They are managed to maintain or improve forage production for livestock.

Management Area 17 (MA 17) - These are grasslands or non-productive timberlands containing important big game habitat and livestock grazing areas. These areas are managed to maintain or improve vegetative conditions and forage production for livestock and wildlife.

Management Area 24 (MA 24) - These are areas which include active or recently active mineral exploration, extraction or processing operations. They are managed for further exploration and development of mineral resources with mitigating affects on renewable resources.

## 3.1 CULTURAL RESOURCES

Previous cultural resource inventories (Lahren 1980a, 1980b, 1989; Lahren et. al. 1982; Mineral Research Center 1982) conducted within and adjacent to SPGMR's proposed permit areas and alternative road corridors for the East Boulder Mine Project have identified a large number and wide variety of prehistoric and historic cultural resource properties. Prehistoric sites predominate, and appear to occur in highest density, in areas adjacent to major stream courses such as the East Boulder River.

Previously recorded prehistoric properties include a variety of campsites, lithic scatters, and pictographs. (The term "campsite" carries a functional connotation. It is generally applied to prehistoric sites which contain evidence of maintenance activities -- such as fire hearths or scraping tools, and/or the remains of prehistoric habitations such as tipi rings. The term "lithic scatter" is a descriptive term, which is applied to sites which consist mostly of lithic debitage, without functionally diagnostic artifacts.) The limited number of temporally diagnostic projectile points recovered from the sites within the greater project area indicate that Native American Indians have occupied the area for at least the last 10,000 years. However, relatively few of the

recorded prehistoric properties have yielded temporally diagnostic materials, and most remain unclassified as to their temporal affiliation. Few properties have been tested to determine the vertical distribution of cultural materials - such testing could produce additional diagnostic materials.

Native American Indian occupation of the area continued through the early historical period. This part of Montana is recognized primarily as the traditional territory of the Crow, Shoshone, and Bannock people. Indeed, the East Boulder River drainage was included within the boundary of the Crow reservation, as established by the 1868 Fort Laramie Treaty. However, a number of different Native American Indian ethnic groups could have included the East Boulder River valley as a component of their traditional use areas. These groups could include the Sioux, Blackfeet, and Salish people. It is possible that one or more of these ethnic groups may have concerns regarding traditional or spiritual/religious use areas within or near the East Boulder River permit areas.

Previously recorded historic properties include the remains of mining ventures (from the period between 1893 and 1902), small homestead complexes (dating from the period between 1890 and 1920), and small isolated cabins (currently un-associated with a specific economic activity or temporal period). Similar to the prehistoric site distribution, historic properties appear to be clustered in areas adjacent to the major stream courses.

Additional types of historic resources which may occur within the affected area include irrigation ditches, isolated community buildings (i.e., schools), and possibly historical roads and/or trails. Although these types of historic sites have not been previously recorded, the results of Historical Research Associates' (HRA) field review of the project area indicates that these types of resources may be present.

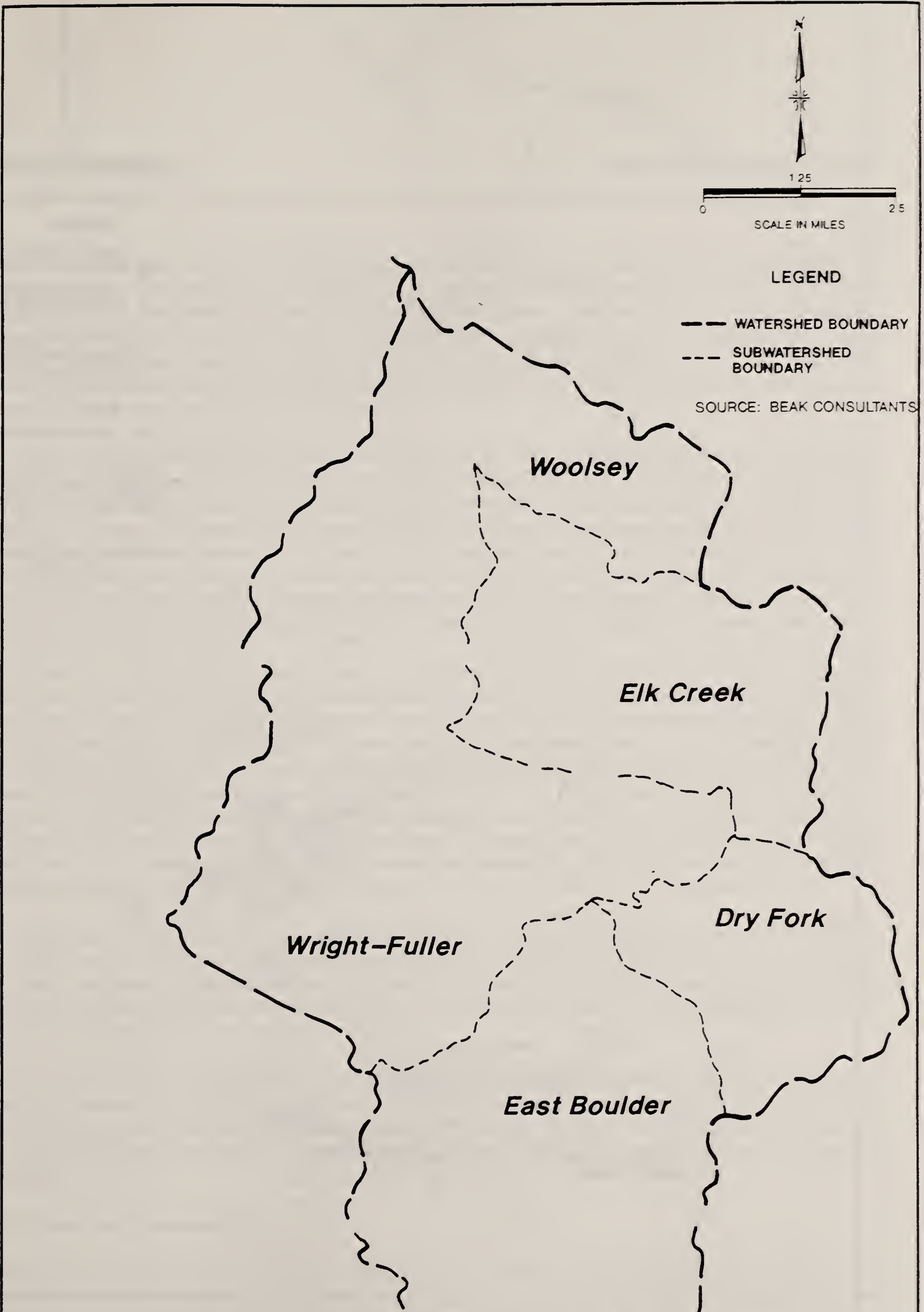
## 3.2 SURFACE WATER

The study area is located in the East Boulder River drainage about 30 air miles south of Big Timber, Montana. The study area for surface water is defined within boundaries that encompass the area bounded by McLeod on the north, Chrome Mountain and FS 140 on the south, the Custer National Forest on the east, and Contact, Green, and Teepee Mountains on the west. Within the study area, several surface water resources are present including the East Boulder River, Brownlee Creek, Canyon Creek, Dry Fork, and two smaller drainageways (see Figure 3.2-1).

Numerous surface water investigations have been conducted or are presently in-progress in the study area. Investigations of flow and water quality have been performed by: Feltis and Wood, (1982), Beak Consultants (1982g), SPGMR (Hydrometrics 1989), and the U.S. Forest Service. Presently, the United States Geological Survey (USGS) is conducting an ongoing study on sedimentation in the Stillwater Complex area. Historical and present surface water quality/quantity stations are presented on Figure 3.2-2.

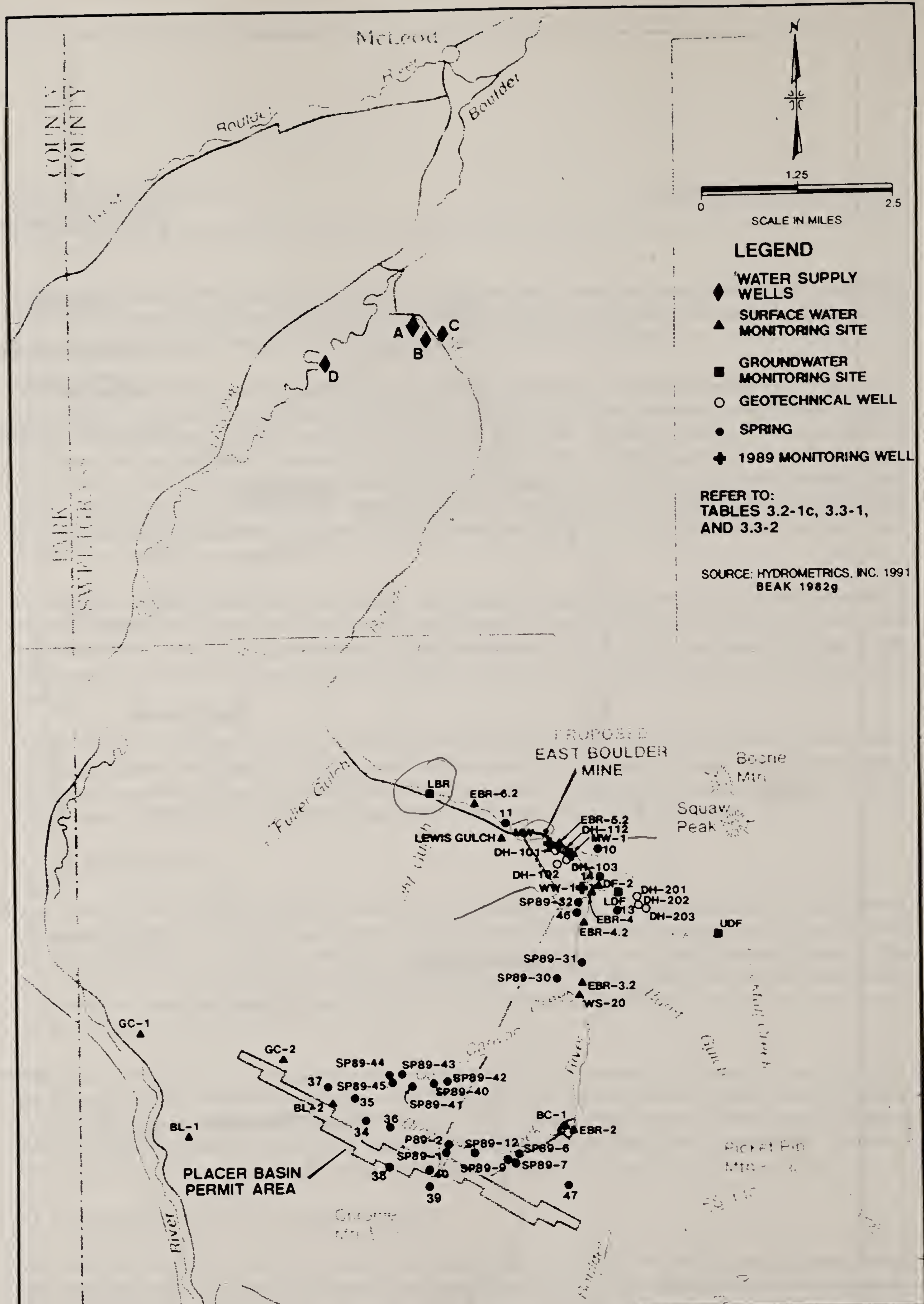
### 3.2.1 Description of Study Area Surface Waters

The East Boulder River has been divided into three segments based on gradient and geomorphology (Hydrometrics 1989). The first segment is the headwaters section. The headwaters of the East Boulder River lie in the Absaroka Range at an elevation of over 10,000 feet. The river in this area is predominantly meandering and sometimes braided with a gradient of approximately 100 feet per mile. It flows through mostly open meadows. The second segment lies in an area extending approximately one mile south to one




EAST BOULDER DRAINAGE BASINS

FIGURE 3.2-1




HYDROLOGIC MONITORING SITES

FIGURE 3.2-2

mile north of the confluence with Brownlee Creek. In this section the river flows through boulder fields and bedrock outcrops. The gradient of this stretch is approximately 1,000 feet per mile. In this area the river is characterized by successive cascades interrupted by small pools. The cascades act as barrier falls to upstream fish migration. The third segment extends from the end of segment two (approximately 1 mile north of the Brownlee Creek confluence) to the project area. In this area the river returns to a flatter gradient (approximately 200 feet per mile) and is often braided. The river bed material in this section is composed mostly of cobbles and small boulders.

The major tributaries to the East Boulder River in the study area are (in downstream order) Brownlee Creek, Canyon Creek, and Dry Fork. Headwaters to Brownlee Creek start as springs or seeps originating as snowmelt recharge along the East Boulder Plateau. Brownlee Creek is a gaining stream in the upper third of the stream. It becomes a losing stream in the central third of the stream length where water is lost to the alluvial and glacial sediments of the valley. The lower third has a very steep gradient as the stream enters the canyon. Brownlee Creek becomes a gaining stream in this area probably due to the thinning of water holding sediments beneath the stream (Hydrometrics 1989). The stream valley in the lower third of Brownlee Creek is filled with glacial boulder material, and the stream is typified by cascades and pools.

The headwaters of Canyon Creek begin as seeps and springs originating from snowmelt recharge. Canyon Creek flows into and out of Camp Lake approximately one mile above the East Boulder River confluence. Camp Lake is a small cirque lake approximately 10 acres in area which contains a self-sustaining population of cutthroat trout which spawn upstream. Above Camp Lake the stream gradient is approximately 400 feet per mile. Below Camp Lake, the stream gradient is approximately 1,600 feet per mile and the stream is characterized by cascades and occasional pools. Canyon Creek is a losing stream and completely disappears 1,000 feet downstream of Camp Lake. The stream reappears approximately 0.2 miles upstream of the confluence with East Boulder River. As discussed later in Chapter Four, it is at present unknown whether Camp Lake and Canyon Creek have a direct hydrologic connection with a fractured bedrock controlled groundwater system that could be intercepted by the East Boulder Mine Project tunneling scheme.

The headwaters of Dry Fork begin as groundwater discharge. The geomorphology of Dry Fork is different from other streams in the area. While the aforementioned stream valleys and the East Boulder River valley are mostly composed of igneous Stillwater Complex rocks and alluvial deposits, the Dry Fork valley is composed of sedimentary rocks and glacial deposits. The Dry Fork gradient is approximately 300 feet per mile, less than most streams in the project area.

There are several other small intermittent drainages that enter the East Boulder River in the study area. Lewis Gulch drains a timber harvest area near the SPGMR facilities. During the high flow events of June 1989, maximum flow in Lewis Gulch was measured at 14.9 cfs. However, all flow in Lewis Gulch was depleted prior to the East Boulder River confluence, either through loss to groundwater or irrigation diversions.

### 3.2.2 Streamflow Characteristics

Virtually all streamflow in the East Boulder River valley is a function of precipitation. Streamflow is the result of either direct precipitation or indirect precipitation such as recharge to the underlying aquifers and subsequent groundwater discharge from seeps and springs. Average annual precipitation in the study area varies from approximately 20 inches near the northern GNF boundary to about 40 inches on Iron Mountain.

The percent of the average annual precipitation that falls as snow varies from approximately 40 percent at an altitude of 6,000 feet to 75 percent at 10,000 feet.

Historical streamflow data exist for the study area from measurements by Hydrometrics (1989), Beak Consultants (1982g), and the USGS (1983, 1984). Flows in the study area are highest in early summer and lowest during the winter months due to heavy snowmelt during the early summer and colder temperatures in the winter. The East Boulder River just below the confluence of Dry Fork (USGS Station 06197800) varied from a low of 5.0 cfs in March 1982 to a high of 588 cfs in late June of 1982 (Feltis and Wood 1982). Other data collected by Beak Consultants reveal streamflow at station EBR5.2 varying from a low of 2.83 cfs to a high of 42.35 cfs, although this low flow was observed in winter and is suspect due to equipment icing. In Brownlee Creek, data collected by Johns-Manville and SPGMR indicate that during the period of record, maximum flow was 14-17 cfs in July of 1980. During low flow conditions, Brownlee Creek contributes approximately 25 percent of the flow in the East Boulder River.

Given the variability of streamflow in the project area, low flow conditions were estimated to help predict the effect of mine operations on the East Boulder River. Of particular interest are the times the East Boulder River is at a low flow condition. Several methods were used to assess the volumes of water associated with low flow conditions. The USGS, along with other regulatory agencies, rely on the 7Q10[1] value for water resources planning and to provide guidance on discharge options.

The estimation of 7Q10 requires daily flow data. There are no recording flow gages in the study area that can provide daily flow data. The nearest station with a considerable record is at Contact, Montana on the main stem of the Boulder River. Beak (1982g) calculated a 7Q10 value at EBR 5.2 using a regression equation. The regression equation involved the use of a linear estimator basing flow on watershed size. The gage at Contact was used as well as the watershed size at EBR 5.2. The value calculated by Beak was 5.0 cfs.

In order to verify this value, other approaches were attempted including an application of the Parret and Omang (1981) method for predicting high flow events in a particular recurrence interval. An additional approach utilized was the procedure outlined by Riggs (1972). The Parret and Omang method gave a value of 15 cfs, while the method outlined by Riggs gave a value of 12 cfs. These other approaches are higher than the Beak estimated value of 5.0 cfs. Therefore, this value will be used in subsequent loading analysis.

Canyon Creek, just upstream from its confluence with the East Boulder River, was measured for flow by Johns-Manville and SPGMR. Data for this station are sporadic. However, for data that do exist, a maximum flow of 24.2 cfs was recorded in September of 1980 and a minimum of no flow was observed in April of 1981. Canyon Creek supplies approximately 10 percent of baseflow to the East Boulder River. Flows in Dry Fork were measured by Beak from April 1981 to April 1982 (Station DF-2). Flows varied from a low of 0.64 cfs in April of 1982 to a high of 16.87 in July of 1981. Dry Fork may contribute as much as approximately 40 percent of the flow in the East Boulder River at the confluence at certain times of the year.

Flood plains within the study area are primarily limited to the alluvial valley bottoms which occur in the East Boulder River valley. This is due to the steep nature of most of the tributary channels (Story 1989). However, limited flood plains occur in the lower gradients of the larger tributaries. Beak (1982g) estimated

[1] 7Q10 is the volume of water associated with a low flow event that occurs for seven days in ten years.

peak discharge at the 2-, 5-, 10-, 25-, 50-, and 100-year recurrence intervals. A regression method was developed by the USGS and required information on drainage area, mean basin elevation, percent of basin above 6,000 feet, and a geographical factor (Parrett and Omang 1981). The results of the analysis indicated that the discharge associated with the "100-year flood" in the East Boulder River valley ranged from 1,232 cfs at flow monitoring Station EBR 5.2 to 201 cfs at the Dry Fork/East Boulder River confluence. The US Forest Service requires that roads, campgrounds, and other structures be located out of the 100-year flood plain. In addition, where facilities are existing in flood plains, protective measures (dikes, rip-rap, etc.) should be constructed. Figure 3.2-3 shows the flood plain boundary of the East Boulder River in the vicinity of the East Boulder permit area for the 1/2 Probable Maximum Flood (PMF). The volume associated with the 1/2 PMF is much larger than the "100-year flood." Therefore, the use of the 1/2 PMF should be considered conservative.

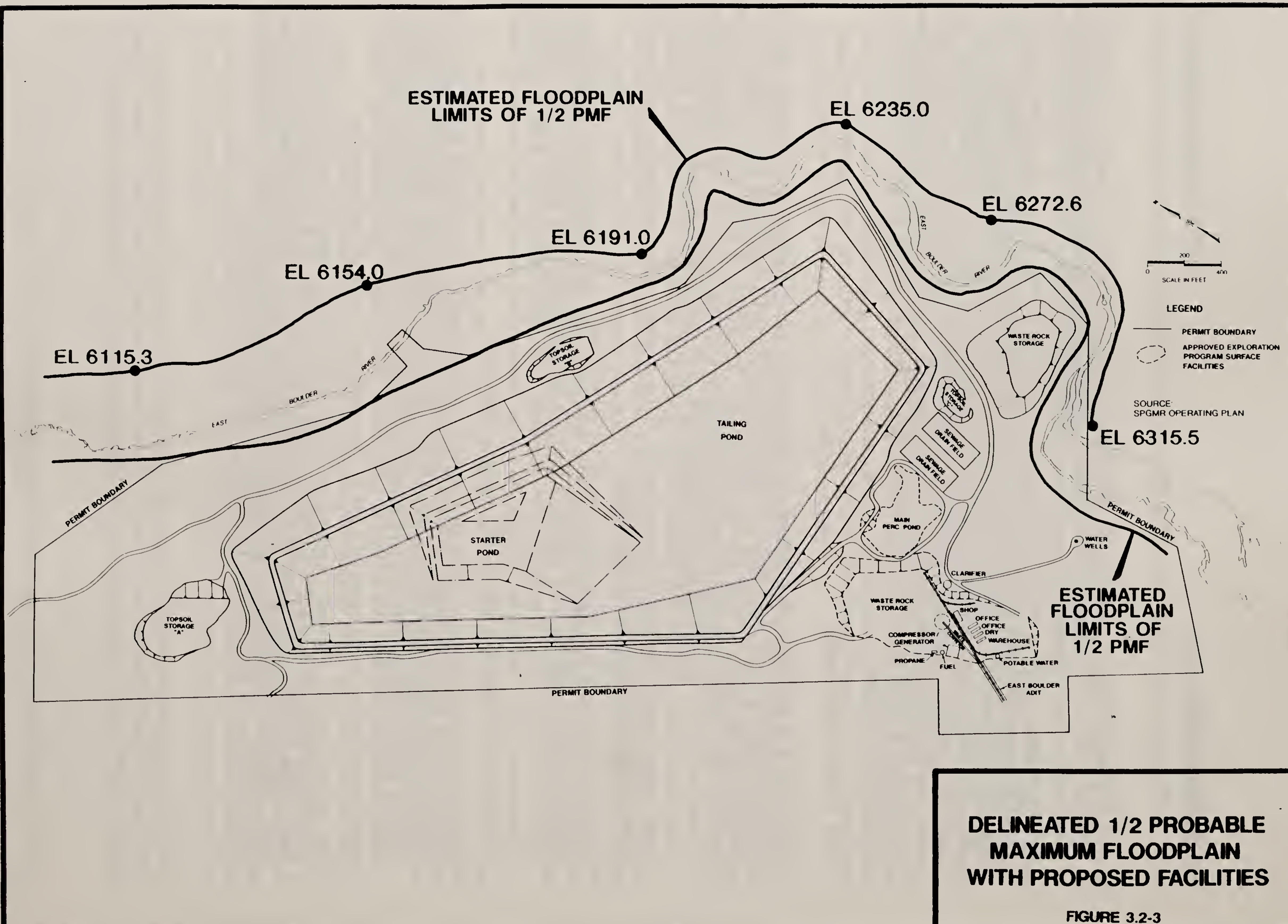
### 3.2.3 Surface Water Quality

Water quality of the study area is generally a function of the type of geologic parent material present, typically Precambrian in the headwaters. Overall, surface water quality in the study area is good with low total dissolved solids (TDS), low metals concentrations, and near neutral pH (Hydrometrics 1989). Surface waters are of a calcium carbonate type and are relatively soft (<60 mg/l as $CaCO_3$). Seasonal fluctuations in water quality occur throughout the East Boulder system. Most surface waters throughout the system have proportionally higher levels of TDS during low flow periods than during high flow periods. Dry Fork has much smaller seasonal fluctuations in water quality. Total dissolved solids concentrations were generally higher in Dry Fork during the high flow period.

Sediment loading from suspended sediment varies seasonally in the East Boulder River and tributaries. During low flow conditions, total suspended sediment (TSS) concentrations were less than analytical detection limits (1 mg/l). During high flow conditions, TSS concentrations varied from 2 to 7 mg/l (Hydrometrics 1990). Using these TSS data, the existing sediment load varies from an approximate low of 7.7 tons/year (low flow) to a high of 5,891 tons/year (high flow).

Sediment loading from bedload also appears to vary seasonally. Bedload data collected during May through July, 1990, at site EBR-5.2 varied from a low of 0.741 tons/year to a high of 1.301 tons/year (Hydrometrics 1990). The higher loading values occurred during the beginning of high flows. The lower bedload occurred during periods of low flows and during the later periods of high flows. Base loadings from suspended sediment and bedload would vary from a low of 8.44 tons/year to a high of 5,892 tons/year.

As stated previously, there have been a number of water quality investigations in the study area. The initial studies by Beak (1982g) collected data on the East Boulder River for a one year period commencing in April 1981. These water quality/quantity investigations accumulated large amounts of data. The data that were generated for Station EBR 5.2 in the Beak study are summarized in Table 3.2-1.




**DELINEATED 1/2 PROBABLE MAXIMUM FLOODPLAIN WITH PROPOSED FACILITIES**

FIGURE 3.2-3

TABLE 3.2-1

AMBIENT AVERAGE SURFACE WATER QUALITY DATA

| Parameter | Beak Data Sample Size | Beak Data Minimum | Beak Data Maximum | Beak Data Mean | USGS Data Sample Size | USGS Data Minimum | USGS Data Maximum | USGS Data Mean | SPGMR Data Sample Size | SPGMR Data Minimum | SPGMR Data Maximum | SPGMR Data Mean | Overall Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General | | | | | | | | | | | | | |
| Temperature (C) | 10 | 0.0 | 12.0 | 4.5 | 14 | 0.0 | 11.0 | 4.6 | 3 | 1.6 | 7.5 | 4.4 | 4.6 |
| pH, lab (Std Units) | 11 | 7.5 | 7.8 | 7.7 | 14 | 7.4 | 8.3 | 7.8 | 4 | 7.0 | 8.2 | 7.7 | 7.7 |
| pH, field (Std Units) | 7 | 6.4 | 8.2 | 7.3 | 14 | 7.0 | 8.2 | 7.7 | 2 | 8.3 | 8.6 | 8.4 | 7.6 |
| Dissolved Oxygen (mg/l) | 6 | 8.8 | 11.6 | 10.8 | 14 | 8.3 | 11.2 | 10.1 | | | | | 10.3 |
| Specific Conductance, lab (umhos/cm) | 11 | 108 | 175 | 155 | 14 | 39 | 210 | 144 | 5 | 4 | 172 | 61 | 134 |
| Specific Conductance, field (umhos/cm) | 9 | 98 | 724 | 256 | | | | | | | | | 256 |
| Instantaneous Discharge (cfs) | 10 | 2.83 | 42.35 | 13.22 | 14 | 5.00 | 588.00 | 70.93 | 3 | 15.43 | 232.06 | 89.30 | 51.60 |
| Turbidity (JTU) | 11 | 0.11 | 0.55 | 0.30 | | | | | | | | | 0.30 |
| Total Suspended Solids (mg/l) | 11 | < 1 | 7 | < 3 | 12 | < 1 | 19 | < 4 | 6 | < 1 | < 1 | < 1 | < 3 |
| Total Dissolved Solids (mg/l) | 11 | 70 | 128 | 100 | | | | | | | | | 100 |
| Total Volatile Suspended Solids (mg/l) | 1 | < 1.0 | < 1.0 | < 1.0 | | | | | | | | | < 1.0 |
| Total Hardness as CaCO3 (mg/l) | 11 | 47.0 | 105.0 | 84.7 | 8 | 18.0 | 110.0 | 78.0 | 4 | 37.0 | 108.0 | 83.5 | 82.2 |
| Oil and Grease (mg/l) | 7 | < 5.0 | < 5.0 | < 5.0 | | | | | | | | | < 5.0 |
| Total Alkalinity (mg/l) | | | | | 14 | 15.0 | 97.0 | 74.2 | | | | | 74.2 |
| Total Organic Carbon (mg/l) | 2 | < 2.0 | < 2.0 | < 2.0 | | | | | | | | | < 2.0 |
| Nutrients | | | | | | | | | | | | | |
| Total Phosphorus as P (mg/l) | 11 | < 0.01 | 0.08 | < 0.02 | | | | | 4 | 0.01 | 0.09 | 0.05 | < 0.03 |
| Orthophosphate as P (mg/l) | 11 | < 0.01 | 0.01 | < 0.01 | 14 | < 0.01 | 0.02 | < 0.01 | 4 | < 0.01 | 0.05 | < 0.03 | < 0.01 |
| Ammonia as N (mg/l) | 11 | < 0.10 | 0.23 | < 0.12 | | | | | 4 | < 0.10 | < 0.10 | < 0.10 | < 0.12 |
| Nitrite + Nitrate as N (mg/l) | 11 | < 0.05 | 0.12 | < 0.07 | 14 | 0.01 | 0.26 | 0.12 | 4 | < 0.05 | < 0.05 | < 0.05 | < 0.09 |
| Total Kjeldahl Nitrogen as N, Unfiltered (mg/l) | 10 | < 0.10 | 0.42 | < 0.13 | 12 | 0.10 | 0.30 | 0.15 | 4 | < 0.10 | 0.90 | < 0.30 | < 0.17 |
| Total Kjeldahl Nitrogen as N, Filtered (mg/l) | 10 | < 0.10 | 0.23 | < 0.11 | | | | | | | | | < 0.11 |
| Total Soluble Inorganic Nitrogen as N (mg/l) | 10 | < 0.10 | 0.32 | < 0.14 | | | | | | | | | < 0.14 |
| Major Cations | | | | | | | | | | | | | |
| Sodium (mg/l) | 11 | < 1.0 | 3.0 | < 1.3 | 1 | 1.1 | 1.1 | 1.1 | | | | | < 1.3 |
| Potassium (mg/l) | 11 | < 1.0 | 1.0 | < 1.0 | 13 | < 0.1 | 0.8 | < 0.3 | | | | | < 0.6 |
| Magnesium (mg/l) | 11 | 3.0 | 8.0 | 6.2 | 12 | 1.7 | 8.1 | 5.5 | | | | | 5.9 |
| Calcium (mg/l) | 11 | 14.0 | 32.0 | 23.9 | 13 | 5.6 | 30.0 | 21.1 | | | | | 22.4 |
| Major Anions | | | | | | | | | | | | | |
| Bicarbonate (mg/l) | 11 | 58.0 | 120.0 | 97.4 | | | | | 4 | 43.0 | 127.0 | 96.0 | 97.0 |
| Sulfate as SO4 (mg/l) | 11 | 1.0 | 7.0 | 5.5 | 14 | 2.0 | 5.0 | 4.2 | 4 | 2.0 | 5.0 | 3.8 | 4.6 |
| Chloride (mg/l) | 11 | < 1.0 | 2.0 | < 1.1 | 14 | 0.1 | 1.0 | 0.4 | 4 | < 1.0 | < 1.0 | < 1.0 | < 0.8 |
| Total Metals | | | | | | | | | | | | | |
| Aluminum (mg/l) | 8 | < 0.1000 | < 0.1000 | < 0.1000 | 13 | 0.0300 | 1.1000 | 0.1230 | 4 | < 0.1000 | < 0.1000 | < 0.1000 | < 0.1120 |
| Antimony (mg/l) | 2 | < 0.0200 | 0.0500 | < 0.0350 | | | | | | | | | < 0.0350 |

**TABLE 3.2-1**

**AMBIENT AVERAGE SURFACE WATER QUALITY DATA**

| Parameter | Beak Data Sample Size | Beak Data Minimum | Beak Data Maximum | Beak Data Mean | USGS Data Sample Size | USGS Data Minimum | USGS Data Maximum | USGS Data Mean | SPGMR Data Sample Size | SPGMR Data Minimum | SPGMR Data Maximum | SPGMR Data Mean | Overall Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic (mg/l) | 3 | < 0.0050 | < 0.0050 | < 0.0050 | 2 | < 0.0010 | < 0.0010 | < 0.0010 | 6 | < 0.0010 | < 0.0050 | < 0.0037 | < 0.0036 |
| Barium (mg/l) | 3 | < 0.1000 | < 0.1000 | < 0.1000 | | | | | 6 | < 0.1000 | < 0.1000 | < 0.1000 | < 0.1000 |
| Beryllium (mg/l) | 2 | < 0.0020 | 0.0050 | < 0.0035 | | | | | 6 | < 0.0050 | < 0.0050 | < 0.0050 | < 0.0046 |
| Boron (mg/l) | 3 | < 0.1000 | < 0.1000 | < 0.1000 | 4 | < 0.0200 | < 0.0200 | < 0.0200 | 2 | < 0.1000 | < 0.1000 | < 0.1000 | < 0.0644 |
| Cadmium (mg/l) | 11 | < 0.0010 | < 0.0010 | < 0.0010 | 12 | < 0.0020 | 0.0040 | < 0.0022 | 6 | < 0.0001 | < 0.0001 | < 0.0001 | < 0.0013 |
| Chromium (mg/l) | 3 | < 0.0200 | < 0.0200 | < 0.0200 | 13 | < 0.0020 | 0.0050 | < 0.0028 | 6 | < 0.0010 | < 0.0010 | < 0.0010 | < 0.0047 |
| Cobalt (mg/l) | 2 | < 0.0300 | < 0.0300 | < 0.0300 | | | | | 2 | < 0.0100 | < 0.0100 | < 0.0100 | < 0.0200 |
| Copper (mg/l) | 11 | < 0.0100 | < 0.0100 | < 0.0100 | 11 | < 0.0020 | 0.0050 | < 0.0025 | 6 | < 0.0100 | < 0.0100 | < 0.0100 | < 0.0071 |
| Iron (mg/l) | 11 | < 0.0300 | 0.0700 | < 0.0340 | 13 | 0.0030 | 0.5700 | 0.0787 | 6 | < 0.0300 | < 0.0300 | < 0.0300 | < 0.0526 |
| Lead (mg/l) | 11 | < 0.0100 | < 0.0100 | < 0.0100 | 13 | < 0.0400 | < 0.0400 | < 0.0400 | 6 | < 0.0020 | < 0.0020 | < 0.0020 | < 0.0214 |
| Lithium (mg/l) | 1 | < 0.0100 | < 0.0100 | < 0.0100 | | < 0.0020 | 0.0040 | < 0.0023 | 2 | < 0.1000 | < 0.1000 | < 0.1000 | < 0.0700 |
| Manganese (mg/l) | 11 | < 0.0100 | 0.0300 | < 0.0200 | 14 | < 0.0010 | 0.0020 | < 0.0011 | 6 | < 0.0200 | < 0.0200 | < 0.0200 | < 0.0115 |
| Mercury (mg/l) | 11 | < 0.0002 | < 0.0002 | < 0.0002 | | | | | 4 | < 0.0002 | < 0.0050 | < 0.0026 | < 0.0008 |
| Molybdenum (mg/l) | 3 | < 0.0050 | < 0.0050 | < 0.0050 | 12 | < 0.0200 | < 0.0200 | < 0.0200 | 2 | < 0.0050 | < 0.0050 | < 0.0050 | < 0.0156 |
| Nickel (mg/l) | 11 | < 0.0300 | < 0.0300 | < 0.0300 | 12 | < 0.0100 | < 0.0100 | < 0.0100 | 6 | < 0.0300 | < 0.0300 | < 0.0300 | < 0.0217 |
| Palladium (mg/l) | 3 | < 0.0050 | < 0.0050 | < 0.0050 | | | | | | | | | < 0.0050 |
| Platinum (mg/l) | 3 | < 0.0050 | < 0.0050 | < 0.0050 | | | | | | | | | < 0.0050 |
| Selenium (mg/l) | 3 | < 0.0050 | < 0.0060 | < 0.0053 | | | | | 6 | < 0.0050 | < 0.0050 | < 0.0050 | < 0.0051 |
| Silver (mg/l) | 3 | < 0.0050 | < 0.0050 | < 0.0050 | 12 | < 0.0020 | 0.0090 | < 0.0027 | 6 | < 0.0005 | < 0.0010 | < 0.0007 | < 0.0025 |
| Strontium (mg/l) | 2 | 0.0500 | 0.1500 | 0.1000 | | | | | | | | | 0.1000 |
| Thallium (mg/l) | 2 | < 0.0500 | < 0.0500 | < 0.0500 | | | | | 2 | < 0.0020 | < 0.0020 | < 0.0020 | < 0.0260 |
| Tin (mg/l) | 2 | < 0.5000 | < 0.5000 | < 0.5000 | | | | | 2 | < 0.1000 | < 0.1000 | < 0.1000 | < 0.3000 |
| Titanium (mg/l) | 2 | < 0.1000 | < 0.1000 | < 0.1000 | 13 | < 0.0010 | 0.0060 | < 0.0029 | 2 | < 0.0100 | < 0.0100 | < 0.0100 | < 0.0152 |
| Vanadium (mg/l) | | | | | 13 | < 0.0010 | 0.0040 | < 0.0019 | | | | | < 0.0019 |
| Zinc (mg/l) | 11 | < 0.0100 | < 0.0100 | < 0.0100 | 12 | < 0.0030 | 0.0300 | < 0.0150 | 6 | < 0.0100 | < 0.1000 | < 0.0280 | < 0.0158 |
| Zirconium (mg/l) | | | | | 13 | < 0.0010 | 0.0060 | < 0.0032 | | | | | < 0.0032 |
| <u>Other</u> | | | | | | | | | | | | | |
| Phenols (mg/l) | 2 | < 0.0 | < 0.0 | < 0.0 | | | | | | | | | < 0.0 |
| Total Cyanide (mg/l) | 2 | < 0.0 | < 0.0 | < 0.0 | | | | | | | | | < 0.0 |
| Total Coliforms (mpn/100 ml) | 2 | 9.0 | 23.0 | 16.0 | | | | | | | | | 16.0 |
| Fecal Coliforms (mpn/100 ml) | 3 | < 1.0 | 2.0 | < 1.3 | | | | | | | | | < 1.3 |
| Fecal Streptococci (mpn/100 ml) | 3 | < 1.0 | 14.0 | < 5.3 | | | | | | | | | < 5.3 |
| Gross Alpha (pci/l) | 3 | 0.0 | 2.0 | 0.7 | | | | | | | | | 0.7 |
| Gross Beta (pci/l) | 3 | -1.0 | 2.0 | 0.3 | | | | | | | | | 0.3 |
| Dissolved Silica (mg/l) | | | | | 13 | 5.8 | 9.2 | 7.9 | | | | | 7.9 |
| Sulfide as S (mg/l) | 11 | < 0.0 | 0.4 | < 0.4 | | | | | | | | | < 0.4 |
| Fluoride (mg/l) | 11 | < 0.1 | 0.1 | < 0.1 | 12 | < 0.0 | 0.1 | < 0.1 | 4 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |

The United States Geological Survey (USGS) also conducted a one-time sampling effort commencing in August 1981, and continuing to August 1983. A total of 14 sampling events were performed at Station EBR-5.2 [2]. The results of the sampling are also presented in Table 3.2-1.

Results from the USGS monitoring are similar to those found by Beak. The USGS study was different in that the detection limits (i.e., the lowest concentration that can be detected by an analytical method) were different than those used by Beak. These lowered detection limits can verify concentrations that would be missed with higher detection limits. The USGS data show a decrease in the amount of water quality variables that were below the detection limits.

The summary statistics presented in Table 3.2-1 for the USGS data were generated from the STORET Water Quality Data Base. The mean was calculated by including all values; those values less than detection limit were included in the calculations as the detection limit values. Mean values from the USGS data show general agreement with those data collected by Beak that are above the detection limit.

SPGMR has also been collecting water quality data in the study area. These studies have been, in part, assessing baseline information for the proposed mine. In an effort to further characterize water quality variables, several sampling events have been performed and the samples analyzed with laboratory methodologies that have lower detection limits. Specifically, samples have been collected from springs and seeps, and at three locations on the East Boulder. The stations are: East Boulder above the proposed facility (EBR-4.2), East Boulder at Upper Bridge (EBR-5.2); and East Boulder above Fuller Gulch (EBR-6.2). Samples were collected in March, June, August, and October 1991. The results of the sampling are presented in Table 3.2-1. A complete list of data from surface waters, including springs and seeps, is included in the Plan of Operations and associated baseline studies.

Overall mean concentrations shown in Table 3.2-1 were determined from the individual means from the three studies and are weighted in accordance with the number of samples represented by each study.

Streams in the study area have been classified by the State of Montana as B-1. Waters classified as B-1 must be suitable for drinking, culinary, and food processing uses after it has been filtered through conventional treatment systems; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supplies. Other physio-chemical standards for waters classified B-1 are included in Administrative Rules of Montana (ARM) 16.20.618. In addition to the surface water quality standards, activities which result in an increase in the concentration of toxic or deleterious substances (ARM 16.20.603[25]) constitute degradation of water quality and are prohibited except as provided in ARM 16.20.701 et seq.

### 3.3 GROUNDWATER

This section discusses the groundwater resources within the SPGMR East Boulder Mine Project study area. Areas of study for groundwater are associated with the East Boulder permit area and the surface areas of recharge above the tunnels and mine workings beneath the Placer Basin permit area (Figure 2.3-3). Data collection focused on the alluvial aquifer upgradient and downgradient from the proposed percolation and

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2 The sampling was performed at Station EBR-5.2. The USGS, however, uses a different station identification system. In USGS records, EBR-5.2 is listed as Station 06197800.

tailing ponds (Figure 3.2-2). Information on groundwater resources for this section has been developed from a review of previous investigations which included installation and monitoring of groundwater wells and wells completed in geotechnical boreholes, and the inventory of spring and domestic wells within the study area. Previous groundwater and geotechnical investigations have been conducted by Feltis and Wood (1982), Beak Consultants (1983c), Hydrometrics (1990) and IECO (1990) in conjunction with DSL and GNF.

### 3.3.1 Groundwater Occurrence

Groundwater occurs in the bedrock and surficial deposits of the East Boulder River Valley. The surficial deposits include the preglacial alluvium (alluvial aquifer), glacial moraine (glacial aquifer), and the localized recent alluvium and glacial outwash along the East Boulder River. Twenty-seven monitoring wells or geotechnical piezometers have been installed as part of the baseline study and geotechnical investigations of the study area (Beak 1983d, IECO 1990, Hydrometrics 1990). Fourteen wells were installed in the Dry Fork Valley; twelve wells were installed in the East Boulder River Valley in the vicinity of the proposed mine facilities and tailings impoundment area; and one well was installed in the lower East Boulder River Valley near the McKinsey Homestead. Additionally, four domestic water wells were located in the lower East Boulder River valley during a spring inventory conducted by Feltis and Wood (1982). These wells are less than 40 feet deep and were completed in glacial moraine or alluvial material. Monitoring well specifications are contained in Table 3.3-1, and information on the domestic water supply wells is contained in Table 3.3-2.

Water level information obtained from the monitoring wells near the East Boulder permit area indicate that depth to groundwater in the alluvial aquifer is approximately 110 feet below ground surface at the east end of the permit area and approximately 25 feet below ground surface along the East Boulder River, west of the permit area. Numerous geotechnical boreholes have also been drilled in the proposed permit area during the geotechnical investigations. Information from selected boreholes in the area of the tailing impoundment is shown in the cross-section represented in Figure 3.3-1. This information along with information from monitoring wells in the area suggest that groundwater is present in the alluvial material at the near surface only in close proximity to the East Boulder River. All wells screened in the glacial aquifer in the permit area have remained dry since they were installed in 1988-89. The direction of groundwater flow in the East Boulder River Valley is toward the northwest following the trend of the valley. Static water levels in monitoring wells show a vertical (downward) potential between the East Boulder River and the glacial and alluvial aquifers (Figure 3.3-1), indicating that some recharge to the aquifers, from the East Boulder River, may occur in the project area vicinity. Groundwater levels in the glacial, alluvial and shallow bedrock aquifers vary seasonally and respond similarly to snowmelt recharge, suggesting that the three aquifers are hydraulically connected to each other.

Surficial materials in the vicinity of the proposed tailings pond and mine facilities consist of poorly sorted glacial moraine ranging in texture from boulders to silt, overlying pre-glacial alluvium with similar textures. Localized recent alluvial deposits and glacial outwash are found adjacent to the East Boulder River. The glacial moraine materials are generally less permeable than the underlying alluvium and acts to hydrologically separate the East Boulder River from the deeper alluvial aquifer. Bedrock was not encountered during drilling in the area, but based on the drilling logs from well WW-1, bedrock is greater than 180 feet. At the two drilling locations (WW-1 and LDF) in the East Boulder River Valley where borings completely penetrated the glacial aquifer, both encountered a low permeability, glacial clay and silt zone (aquitard) in the lower part of the glacial aquifer. The lateral continuity of this zone is not known but where it exists, the hydraulic connection between the glacial aquifer and the underlying alluvial aquifer may be limited.

## TABLE 3.3-1
## WELL COMPLETION SPECIFICATIONS

| Well Number and Location | Total Depth Drilled (ft) | Total Depth Cased (ft) | Casing Diam & Type (in) | Perforated or Screened Interval (ft) | Aquifer(s) Producing Water | Elevation of GS and How Determined (ft) | Depth to SWL below MP (ft) | Date Meas. (M-D-Y) | Well Use | Date Drilled (Mo-Yr) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LBR-1 | 98 | 77 | 3 | 20-77 | Glacial & Alluvium | 5845.4 | 24.26 | 09/24/82 | Monitoring | 7/82 | |
| MW-1 (T45 R13E 2 CD) | 60 | 60 | 6 Steel | 25-50 | Alluvial | 6167 Map | 24.92 | 11/08/89 | Monitoring | 10/89 | |
| MW-2 (R45 R13E 2 CD) | 60 | 60 | 6 Steel | 25-55 | Alluvial | 6144 Map | 21.56 | 11/08/89 | Monitoring | 10/89 | |
| WW-1 (T45 R13E 11 CA) | 180 | 180 | 8 Steel | 130-170 | Alluvial | 6323.0 Map | 106.72 | 11/08/89 | Mon./Indus. | 10/89 | |
| DH-101 | 45 | 43 | 1 PVC | 33-43 | Glacial | 6205.0 | Dry | 9/11/89 | Geotech. | 01/88 | |
| DH-102 | 60 | 60 | 1 PVC | 40-60 | Glacial | 6252.0 | Dry | 9/11/89 | Geotech. | 01/88 | |
| DH-103 | 60 | 60 | 1 PVC | 40-60 | Glacial | 6242.0 | Dry | 9/11/89 | Geotech. | 01/88 | |
| DH-111 | 84 | 73.9 | 1 PVC | 53.9-73.9 | Glacial | 6273.5 | Dry | 9/11/89 | Geotech. | 7/89 | |
| DH-112 | 78.5 | 75.5 | 1 PVC | 55.5-75.5 | Glacial | 6166.4 | 24.1 | 9/11/89 | Geotech. | 7/89 | |
| DH-113 | 69 | 65 | 1 PVC | 45-65 | Glacial | 6224.9 | Dry | 9/11/89 | Geotech. | 7/89 | |
| DH-114 | 78 | 78 | 1 PVC | 58-78 | Glacial | 6309.0 | Dry | 9/11/89 | Geotech. | 7/89 | |
| DH-115 | 32 | 30 | NI | | Glacial | 6142.0 | Dry | 7/26/89 | Geotech. | 7/89 | |
| DH-116 | 28.5 | 28.5 | NI | | Glacial | 6322.60 | Dry | 7/19/89 | Geotech. | 7/89 | |
| LDF-1 | 83 | 83 | 6 | 23-83 | Glacial | 6351.20 Surveyed | 17.9 | 11/08/89 | Monitoring | 3/82 | Sand packed |
| LDF-2 | 89.6 | 89.6 | 2 | 22-82 | Glacial | 6352.71 Surveyed | 21.15 | 11/08/89 | Monitoring | 11/81 | Sand packed |
| LDF-3 | 105.9 | 90.6 | 2 | 99-101 | Glacial Aquitard | 6354.96 Surveyed | 52.02 | 11/08/89 | Monitoring | 12/81 | Sand packed |
| LDF-4 | 162.2 | 162 | 2 | 150-161 | Alluvial | 6350.36 Surveyed | 98.53 | 11/08/89 | Monitoring | 2/82 | Sand packed |
| LDF-5U | 80.0 | 68.6 | 2 | 17-42 | Glacial | 6339.40 Surveyed | 15.86 | 09/11/89 | Monitoring | 11/81 | Sand packed dual completion with 5L |
| LDF-5L | 80.0 | 68.6 | 2 | 69-71 | Glacial Aquitard | 6339.40 Surveyed | 32.50 | 09/11/89 | Monitoring | 11/81 | Sand packed dual completion with 5U |
| LDF-7 | 290.0 | 206.1 | 2 | 218-225 | Bedrock | 6354.24 Surveyed | 80.81 | 11/08/89 | Monitoring | 11/81 | Sand packed |
| UDF-1 | 171 | 171 | 6 PVC | 144-165 | Alluvial | 6671.60 Surveyed | 113.51 | 11/09/89 | Monitoring | 10/81 | Jet perforated steel 0.02" slot PVC |
| UDF-2 | 170 | 164 | 2 | 82-161 | Alluvial | 6669.30 Surveyed | 111.28 | 11/09/89 | Monitoring | 10/81 | Sand packed |
| UDF-3 | 271 | 269 | 2 | 186-265 | Bedrock | 6675.53 Surveyed | 124.74 | 11/09/89 | Monitoring | 10/81 | Sand packed |
| UDF-4 | 188 | 185 | 2 | 80-180 | Alluvial | 6673.65 Surveyed | 65.61 | 09/24/82 | Monitoring | 10/81 | Sand packed |

Note: GS = Ground Surface; SWL - Static Water Level; MP = Measuring Point; NR - No Record; NI = Not Installed

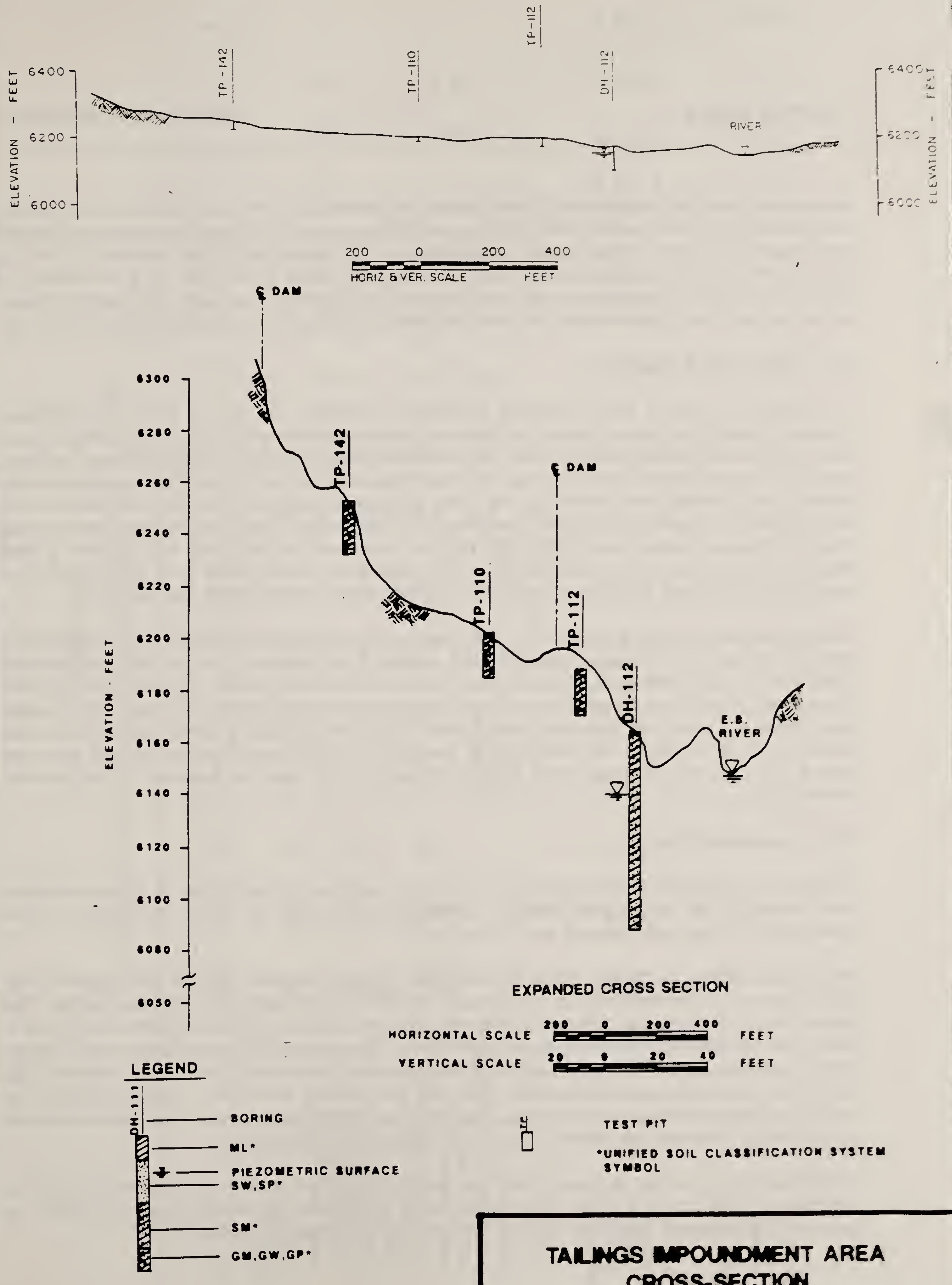
TABLE 3.3-2

WATER SUPPLY WELLS

| Well #[a] Number | Well # | Date Inventoried | Depth (feet) | Casing Diameter (inches) | Year Drilled | Geologic Completion | Depth to Water Level (feet) | Discharge (gpm) | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| A | 2S13E33CDAD | 4-8-81 | 38 | -- | -- | Alluvium or glacial moraine | -- | -- | Chemical analysis |
| B | 3S13ED4AABD | 4-2-81 | 30 | 5 | 1967 | Alluvium or glacial moraine | 5.1 | 6.0 | Chemical analysis first perforation at 12 feet |
| C | 3S13E04ABAD | 4-1-81 | 21 | 4 | 1966 | Alluvium or moraine | 8.8 | 5.5 | Chemical glacial analysis |
| D | 3S13E45BACD | 4-1-81 | 9 | | 1949 | Alluvium moraine | -- | 3.8 | Chemical or glacial analysis |

[a] Well numbers correspond with locations on Plate 5-1

Source: Feltis and Wood 1982




SOURCE: ADAPTED FROM IECO, 1980

**TAILINGS IMPOUNDMENT AREA CROSS-SECTION**

FIGURE 3.3-1

Information on aquifer characteristics (permeability and transmissivity) was obtained from aquifer testing conducted as part of the baseline study. Field permeability tests conducted during geotechnical drilling for the impoundment (IECO 1990) showed permeabilities in the unsaturated glacial moraine of $7x10^{-3}$ to $2x10^{-6}$ cm/sec. A test conducted in the deep alluvial aquifer (well WW-1) showed a permeability of $7x10^{-3}$ cm/sec and a transmissivity of 1018 $feet^2$/day, and a test conducted on a well completed in bedrock in the lower Dry Fork Valley resulted in a permeability of $2.5x10^{-4}$ cm/sec and transmissivity of 5 $feet^2$/day.

### 3.3.2 Placer Basin Permit Area

The Placer Basin permit area is underlain by Paleozoic sediments and igneous rock of the Stillwater Complex (Beak 1982d). Groundwater in the Madison limestone and other sedimentary units is likely present as a result of both primary matrix porosity and secondary permeability due to joints, fractures, and fault zones. The permeability of unfractured igneous rocks typically is very low because their crystalline nature results in very few void spaces within the rock matrix for transmitting water. The crystalline igneous rocks of the Stillwater Complex are relatively extensively jointed and faulted. Field reconnaissance and reporting near the proposed project area by SPGMR (1982) of joints near the Frog Pond adit indicated a small amount of water being present within the joints. The water derived from joints is most likely shallow (less than 100 feet) with little if any water being found in joints below 250 feet (Davis and Turk 1964).

The amount of water derived from joints is much less than the potential movement of water through fault zones in the area. Several major faults have been mapped in the vicinity of the mine site: the Brownlee Creek Fault, Castle Creek Fault, Fishscale Fault, and two minor faults between the Brownlee and Castle Creek Faults. Faults have the possibility of containing wide shear zones composed of broken, very angular rock fragments. Water can flow freely through these zones due to the large interconnected void spaces between the rock fragments. An example of the magnitude at which water flows through fault zones was seen in an adit at the Stillwater West Fork in December 1976, where a discharge of 600 gpm was encountered.

### 3.3.3 Groundwater Quality

Groundwater in the East Boulder permit area is of good quality and is within State of Montana drinking water standards for Class I groundwaters. Levels of trace metals are low or undetectable. Low concentrations of zinc were detected in all of the wells.

Monitor wells MW-1 and MW-2, which are completed in shallow alluvium near the East Boulder River, differ in major ion concentration from both monitor well WW-1, completed in deep alluvium, and the East Boulder River. In November 1989 the shallow wells contained total dissolved solids (TDS) nearly twice as high as the adjacent East Boulder River and well WW-1. The elevated TDS concentration of the shallow wells is most probably a result of groundwater flow contribution from the Dry Fork Valley, which has high TDS levels, mixing with contributions from infiltrating East Boulder River water. The Dry Fork Valley contains abundant sedimentary rocks including limestones that yield higher amounts of dissolved constituents than do the igneous rocks that make up most of the upper East Boulder Valley.

Groundwater in the deeper alluvium in the East Boulder Valley is a factor of three lower in TDS than groundwater in the Dry Fork Valley. This is also a result of differences in bedrock types in the valleys. A summary of groundwater quality for selected wells in the area is contained in Table 3.3-3.

TABLE 3.3-3

GROUNDWATER QUALITY OF SELECTED WELLS IN THE STUDY AREA

| Parameter | Well Number | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MW-1* | MW-2* | WW-1* | UDF-1* | UDF-2 | UDF-3 | LDF-1* | LDF-2 | LDF-3 | LDF-4 | LDF-7 | LBR-1 | A | B | C | D |
| General | | | | | | | | | | | | | | | | |
| pH (Field) | - | - | - | - | 8.14 | 7.72 | - | 7.80 | 7.90 | 7.63 | 7.67 | 7.76 | 7.7 | 7.5 | 7.4 | 7.1 |
| pH (Lab) | 8.0 | 7.9 | 7.9 | 8.0 | 7.8 | 7.6 | 7.9 | 7.9 | 8.0 | 7.8 | 7.5 | 7.7 | - | - | - | - |
| Specific Conductance (Field) umhos/cm @ 25°C | - | - | - | | 270 | 313 | - | 314 | 321 | 274 | 311 | 199 | 199 | 427 | 413 | 237 |
| Specific Conductance (Lab) umhos/cm @ 25°C | 261 | 279 | 171 | 318 | 287 | 337 | 347 | 330 | 353 | 294 | 348 | 225 | - | - | - | - |
| Temperature (Field) °C | 5 | 6.5 | - | 5 | 6.7 | 6.8 | - | 6.0 | 10.3 | 7 | 7.8 | 11.1 | 7.5 | 4.0 | 3.5 | 5.0 |
| Temperature (Lab) °C | - | - | - | - | 5 | 5 | - | 5 | 5 | 5 | 5 | 5 | - | - | - | - |
| Total Dissolved Solids @ 180°C | 124 | 143 | 88 | 161 | 150 | 177 | 185 | 183 | 188 | 150 | 167 | 115 | - | - | - | - |
| Total Hardness as $CaCO_3$ | 139 | 152 | 90 | 178 | 164 | 194 | 195 | 196 | 194 | 167 | 187 | 121 | 380 | 210 | 200 | 100 |
| Water level Ft. BGS | | | | - | 64.53 | 73.14 | 12.77 | - | - | 87.46 | 67.54 | 24.74 | - | 5.1 | 8.8 | - |
| Quantity removed below sampling (gal) | | | | 2,038 | 60 | 126 | 135 | 20 | 15 | 35 | 30 | 55 | - | - | - | - |
| Sampling method | - | - | - | Submer -sible | PDP | PDP | Submer -sible | PDP | PDP | PD | PDP | PDP | - | - | - | - |
| Sampling Ft. BGS | - | - | - | 109 | 100 | 73.140 | Pump 50 | 30 | 90 | 155 | 20 | 80 | - | - | - | - |
| Major Cations | | | | | | | | | | | | | | | | |
| Calcium | 40 | 42 | 25 | 50 | 48 | 51 | 52 | 52 | 50 | 46 | 49 | 35 | 100 | 56 | 54 | 25 |
| Magnesium | 9 | 11 | 7 | 13 | 11 | 16 | 16 | 16 | 17 | 13 | 16 | 8 | 30 | 16 | 15 | 10 |
| Potassium | <1 | 1 | <1 | 1 | 1 | <1 | 1 | <1 | <1 | <1 | 1 | <1 | 2 | 2 | 1 | 1 |
| Sodium | | | | <1 | 2 | 1 | <1 | 1 | 5 | 11 | 5 | 2 | 8.6 | 6.1 | 5.6 | 5 |
| Major Anions | | | | | | | | | | | | | | | | |
| Bicarbonate | 171 | 178 | 112 | 204 | 177 | 208 | 236 | 218 | 218 | 182 | 216 | 130 | 240 | 190 | 180 | 85 |
| Carbonate | - | - | - | - | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chloride | 2 | <1 | 1 | <1 | 2 | <1 | <1 | 1 | 1 | <1 | 1 | <1 | 1.3 | .7 | .7 | .7 |
| Sulfate | 6 | 15 | 6 | 15 | 15 | 1 | 9 | 9 | 15 | 11 | 12 | 8 | 200 | 63 | 5.6 | 421 |

TABLE 3.3-3
(Continued)

| Parameter | Well Number | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MW-1* | MW-2* | WW-1* | UDF-1* | UDF-2 | UDF-3 | LDF-1* | LDF-2 | LDF-3 | LDF-4 | LDF-7 | LBR-1 | A | B | C | D |
| Other | | | | | | | | | | | | | | | | |
| Fluoride | <0.10 | 0.12 | <0.10 | 0.15 | <.1 | <.1 | 0.16 | .1 | .1 | .1 | .12 | <.1 | .3 | .2 | .1 | .1 |
| Silica | - | - | - | - | 5.5 | 5.8 | - | 9.2 | 8.9 | 5.4 | 7.6 | 8.6 | 9.6 | 11 | 9.7 | 13 |
| Sulfide | - | - | - | - | <0.4 | <.04 | - | <.04 | <.04 | <.04 | <.04 | <.04 | - | - | - | - |
| Organics | | | | | | | | | | | | | | | | |
| Total Kjeldahl Nitrogen as N | <.1 | <.1 | <.1 | <.1 | <.1 | .2 | <.1 | .2 | .3 | .3 | .5 | .2 | - | - | - | - |
| Total Organic Carbon | - | - | - | - | <.2 | <2 | - | - | <2 | <2 | <2 | - | - | - | - | - |
| Cyanide | - | - | - | - | <.005 | <.005 | -- | <.005 | <.005 | <.005 | <.005 | <.005 | - | - | - | - |
| Phenol | - | - | - | - | <.01 | <.01 | -- | <.01 | <.01 | <.01 | <.01 | <.01 | - | - | - | - |
| Nutrients | | | | | | | | | | | | | | | | |
| Ammonia as N | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | - | - | - | - |
| Nitrate and Nitrite as N | .10 | .14 | .09 | .13 | .07 | .13 | .11 | .11 | .12 | .15 | .15 | .07 | - | - | - | - |
| Ortho-Phosphate as P | .01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | - | - | - | - |
| Total Phosphate as P | .01 | <.01 | <.01 | .01 | <.01 | <.01 | <.01 | .02 | .01 | <.01 | <.01 | .01 | - | - | - | - |
| | | | | - | - | - | - | - | - | - | - | - | .2 | .18 | .16 | .40 |
| Radiochemistry | | | | | | | | | | | | | | | | |
| Gross Alpha (piC/l) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Gross Beta ((piC/l) | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Calculated Parameters | | | | | | | | | | | | | | | | |
| Sum of Cations | - | - | - | 3.33 | 3.41 | 3.93 | 3.93 | 4.02 | 4.13 | 3.43 | 4.00 | 2.52 | 7.88 | 4.42 | 4.19 | 2.31 |
| Sum of Anions | - | - | - | 3.07 | 3.28 | 3.72 | 3.67 | 3.80 | 3.93 | 3.26 | 3.84 | 2.34 | 8.16 | 4.47 | 4.19 | 2.32 |
| Cation/Anion Balance (as % difference) | - | - | - | <8.16 | 3.84 | 5.27 | 6.7 | 5.51 | 5.03 | 5.17 | 4.16 | 7.35 | 3.58 | 1.05 | 0.02 | 0.46 |
| SAR (Sodium Adsorption Ratio) | - | - | - | .06 | .07 | .03 | .06 | .06 | .16 | .03 | .16 | 0.08 | .19 | .19 | .17 | .21 |
| Total Soluble Inorganic Nitrogen as N | - | - | - | .05 | .1 | .1 | .05 | .1 | .1 | .2 | .2 | 1 | - | - | - | - |

TABLE 3.3-3
(Concluded)

| Parameter | Well Number | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MW-1* | MW-2* | WW-1* | UDF-1* | UDF-2 | UDF-3 | LDF-1* | LDF-2 | LDF-3 | LDF-4 | LDF-7 | LBR-1 | A | B | C | D |
| <u>Trace Metals</u> | | | | | | | | | | | | | | | | |
| Aluminum | - | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | - | - | - | - |
| Antimony | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Arsenic | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | - | - | - | - |
| Barium | - | <.1 | <.1 | <.1 | .1 | .1 | <.1 | .1 | .1 | .1 | .1 | <.1 | - | - | - | - |
| Beryllium | - | <.005 | <.005 | <.005 | - | - | <.005 | - | - | - | - | - | - | - | - | - |
| Boron | - | <.1 | <.1 | <.01 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | <.1 | - | - | - | - |
| Cadmium | <.001 | <.001 | <.001 | <.001 | .001 | .001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | - | - | - | - |
| Chromium | - | <.02 | <.02 | <.02 | - | <.02 | <.02 | <.02 | <.02 | <.02 | <.02 | <.002 | - | - | - | - |
| Cobalt | - | <.01 | <.01 | <.01 | - | - | <.01 | - | - | - | - | - | - | - | - | - |
| Copper | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | - | - | - | - |
| Iron | <.03 | .09 | .03 | .04 | <.03 | <.03 | .19 | .03 | <.03 | <.03 | <.03 | .04 | .13 | .008 | .01 | .003 |
| Lead | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | <.01 | .01 | - | - | - | - |
| Manganese | <.02 | .002 | <.02 | <.02 | <.02 | <.02 | <.02 | <.02 | .04 | <.01 | <.02 | <.02 | .02 | <.001 | .003 | .001 |
| Mercury | - | <.001 | <.001 | <.001 | <.0002 | <.0002 | <.001 | <.0002 | <.0002 | <.0002 | <.0002 | <.002 | - | - | - | - |
| Molybdenum | - | <.005 | <.005 | <.005 | - | - | <.005 | - | - | - | - | - | - | - | - | - |
| Nickel | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | <.03 | - | - | - | - |
| Palladium | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Platinum | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Selenium | - | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | - | - | - | - |
| Silver | - | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | <.005 | - | - | - | - |
| Strontium | - | - | - | - | 0.2 | 0.4 | - | .2 | .2 | .3 | .6 | .2 | - | - | - | - |
| Thallium | - | <.1 | <.1 | <.1 | - | - | <.1 | - | - | - | - | - | - | - | - | - |
| Titanium | - | <.01 | <.01 | <.1 | - | - | <.01 | - | - | - | - | - | - | - | - | - |
| Tin | - | <.1 | <.1 | <.1 | - | - | <.1 | - | - | - | - | - | - | - | - | - |
| Zinc | .03 | .04 | .03 | .07 | .01 | <.01 | .01 | .01 | .01 | .01 | .01 | .01 | - | - | - | - |

All units reported as mg/l unless otherwise noted. Parameters analyzed as dissolved constituents. PDP = Positive Displacement Pump. piC/l = picocurie/liter.

Source: Beak Consultants 1983c.

* Hyprometrics 1990

Montana groundwater regulations (ARM 16.20.1001 et seq) classify groundwater into four classes based on existing quality and use. Groundwater which is used for drinking water purposes shall not exceed drinking water maximum contaminant levels (MCL). Any increase in the concentration of a parameter for which there exists a drinking water MCL, or which precludes the use of the water as a drinking water source, constitutes degradation and is prohibited except as provided in ARM 16.20.701 et seq.

## 3.4 SOILS

Soil information has been collected by both the US Forest Service and by consultants to SPGMR. An Order 3 soil survey of the GNF was completed in 1984. This survey provides general soil information about the entire project area. The study area for soil resources is limited to the three project permit areas (Figure 2.3-3). An Order 1 soil survey of the East Boulder Mine Project site was completed in 1990 by a private consulting firm. This survey provides more detailed soil information for the East Boulder Mine Project site.

### 3.4.1 General Soil Conditions

Soil conditions across the study area are highly variable due to differences in the soil-forming factors of parent material, topography, vegetation, climate, and time. Parent materials within the project area include a wide variety of rock types and deposits. Figure 3.4-1 illustrates very general relations of soil and parent materials to elevation in the project area. Limestone, sandstone, shale, gneiss, and granite are the most common rock types. Colluvium, alluvium, and glacial till are the most common erosional deposits. Topography ranges from nearly level stream terraces and ridges to nearly vertical cirque headwalls, canyon walls, and stream terrace edges. Vegetation ranges from streambank riparian shrub communities to wind-deformed subalpine conifer forest and alpine meadow. The climate is generally dry and cold (annual precipitation 20-25 inches, annual temperature 38°F). Soils are young, having formed in deposits of recent geologic age, and often display little alteration from their original condition.

In general, soils are deepest and most developed in valley-bottom positions and on lower mountain slopes where glaciers, streams, and gravity have deposited fine parent material. They are usually deep with loam, sandy loam and clay loam textures. Rock contents are commonly 20 to 50 percent. Soils on sites with abundant grasses and forbs may have a dark surface layer. Soils are shallowest and least productive on the upper slopes, steep areas, and near rock outcrops. These soils usually have sandy loam textures and 50 to 70 percent rock fragments. Overall, there is some good quality soil available for reclamation purposes in some areas.

### 3.4.2 Soil Conditions at Proposed Sites of Disturbance

The East Boulder Mine Project includes approximately 844 acres, of which about 233 acres may be disturbed at three separate sites (see Figure 2.3-3). The amount of soil available for salvage was originally estimated as approximately 68,000 cubic yards. The Order 1 soil survey of the East Boulder permit area suggests that considerably more is available although some lower soil horizons are included in this estimate. Salvage and stockpiling many of these soils will be difficult due to high rock content including boulders in some areas. Approximately 487,000 bank cubic yards are estimated to be available for reclamation. A more detailed discussion of soil features is presented for each of these three disturbance sites.

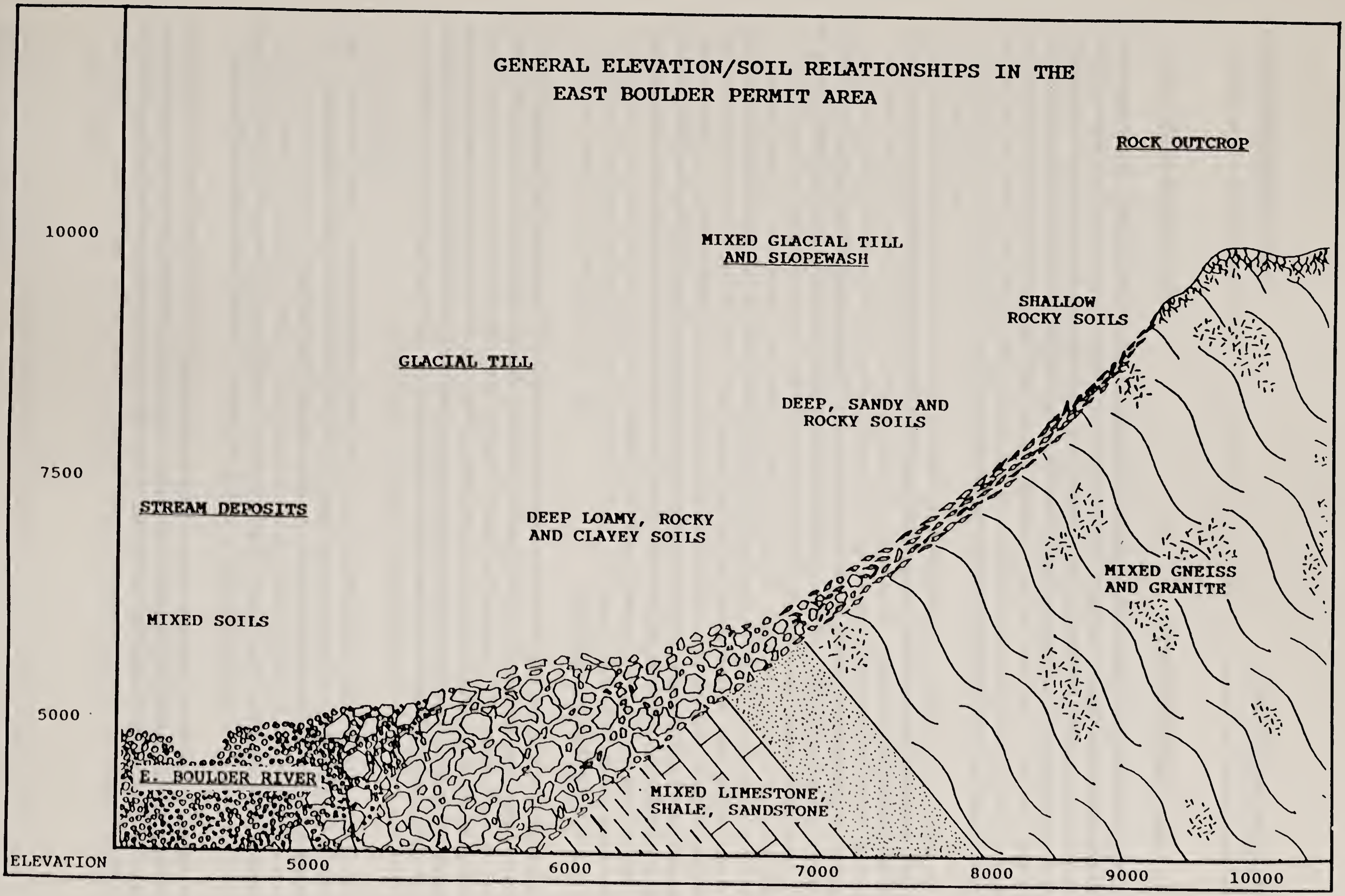

GENERAL ELEVATION/SOIL RELATIONSHIPS IN THE
EAST BOULDER PERMIT AREA
ROCK OUTCROP
10000
MIXED GLACIAL TILL
AND SLOPEWASH
SHALLOW
ROCKY SOILS
GLACIAL TILL
DEEP, SANDY AND
ROCKY SOILS
7500
STREAM DEPOSITS
DEEP LOAMY, ROCKY
AND CLAYEY SOILS
MIXED GNEISS
AND GRANITE
MIXED SOILS
5000
E. BOULDER RIVER
MIXED LIMESTONE,
SHALE, SANDSTONE
ELEVATION
5000
6000
7000
8000
9000
10000

FIGURE 3.4-1

3.4.2.1 East Boulder Permit Area

Soils at the East Boulder permit area (main mine area) are mostly formed in glacial till parent material containing mixed rock types. This glacial till has loam and clay loam textures with 20 to 50 percent rock fragments from gravel to boulder size. Soils usually have a gravelly loam surface layer and very gravelly loam to clayloam subsoils. Small areas of soils occur along the immediate stream channel formed in stream deposits (alluvium). These soils are highly variable and may have sandy to clayey textures. Alluvial soils within and near the floodplain have shallow water tables for portions of the year. Most soils at the East Boulder permit area are classified as Cryoboralfs and Cryoborolls.

Topography of this location is a rolling glacial till landscape bordered by steep mountain slopes. Soils are usually thinner and less developed on steeper slopes and drier exposures. Nearly level stream terraces parallel portions of the stream.

Vegetation is mostly dry conifer forest which adds an organic "litter" layer to the soil surface consisting of partially decomposed needles, twigs, and other plant parts. Small areas dominated by grasses, aspen, or certain moist-site species have surface soils that are high in organic matter and very dark in color.

Soils at this location are among the better soils in the general area since they are deep and have silt and clay contents ranging from 20 to 50 percent for the silt fraction and 5 to 15 percent for the clay fraction. They have much higher moisture and nutrient holding capacities than many other local soils. These features reduce erosion potential and promote revegetation and reclamation. These soils have moderate erosion potentials when the surface organic layer is removed. They do not have adverse chemical properties such as low pH, high salts, excess carbonates, or heavy metals.

3.4.2.2 Brownlee Creek Permit Area

Soils at the Brownlee Creek permit area are mostly formed in glacial till parent material dominated by hard, coarse-grained igneous rocks or metamorphosed crystalline rocks. This glacial till has sandy loam textures with 30 to 60 percent rock fragments from gravel to boulder size. Soils usually have a gravelly sandy loam surface layer and very gravelly sandy loam subsoil. Small areas of soils occur along the immediate stream channel formed in stream deposits. These soils often have more sand and rock than glacial till soils. Stream deposit soils may also have shallow water tables for portions of the year. Most soils at the Brownlee Creek permit area are classified as loamy-skeletal, mixed, Typic Cryochrepts.

Topography at the Brownlee Creek permit area is a moderately sloping landscape of mixed glacial and slope-wash deposits bordered by steep mountain slopes. Soils are usually thinner and less developed on the steeper slopes. Nearly level stream terraces parallel portions of the stream.

Vegetation is sparse, but when present consists mostly of cold, dry conifer forest which adds an organic "litter" layer to the soil surface consisting of partially decomposed needles, twigs, and other plant parts.

These soils have relatively low moisture and nutrient holding capacities. They have moderate to high erosion potentials when the surface organic layer is removed. Revegetation, reclamation, and erosion control should be relatively easy with these soils in this climate. These soils do not have adverse chemical properties such as low pH, high salts, excess carbonates, or heavy metals.

### 3.4.2.3 Placer Basin Permit Area

Soils at locations to be disturbed throughout the Placer Basin permit area are mostly formed in granite and gneiss. The source of most soil materials is weathered bedrock with minor additions of materials left by glaciation or carried to the site by wind. These soils often have very gravelly silt loam, or sandy loam surface soils and extremely gravelly sandy loam subsoils. Shallow soils dominate this area and all are very rocky. Hard bedrock often occurs at shallow depths (<20 inches).

Topography at most of the disturbance locations is gently rolling ridgetop and plateau. The 8650 adit site is on steeper slopes.

Vegetation is mostly cold, wind-formed conifer forest near the limits of tree growth, although pockets of well developed lodgepole pine, Douglas-fir, and subalpine fir can be found. These trees add an organic "litter" layer to the soil surface consisting of partially decomposed needles, twigs, and other plant parts. Some sites have alpine meadow vegetation dominated by grasses, sedges, and forbs. Soils at these non-forest sites often have a surface layer high in organic matter and are very dark in color.

These soils have very low moisture and nutrient holding capacities. They have moderate erosion potentials when the surface organic layer is removed.

Reclamation can prove difficult with most of these soils due to shallow depth, high rock content, and cold climate. High rock content in the surface reduces space for plants to root and reduces their access to water and nutrients. The shallow depth to bedrock can create extremes of moisture which impede plant growth. Soils may be saturated in spring and early summer from snowmelt waters "perched" on bedrock. Soils may then dry out rapidly to extremely low total moisture contents, presenting plants with drought stress that were, just a few weeks before, saturated with water.

Despite physical soil problems, these soils do not have adverse chemical properties such as low pH, high salts, excess carbonates, or heavy metals.

Separating and saving potential soil materials on these sites can be difficult due to thin soil, rock content, and shallowness. Soil suited to reclamation is usually only a few inches thick or less. Some sites may be more rationally reclaimed to rock or talus if these fit the prior condition of final landscape setting.

## 3.5 GEOLOGY

The platinum group metals (PGM) that SPGMR proposes to extract are found in the Stillwater Complex, a 1- to 5-mile-thick by 28-mile-long geologic formation consisting of layers of iron and magnesium-rich generally dark-colored igneous rocks. For the purpose of this discussion, the study area for geology may be considered the Stillwater Geologic Complex, with reference to specific units/outcrops/conditions near the proposed East Boulder Mine Project.

The igneous rocks of the Stillwater Complex are comprised mainly of accumulations of crystals of plagioclase feldspar, pyroxene, and olivine that differentially settled out of a magma due to the action of gravity and complex thermodynamic processes within the magma chamber. Geologists refer to these minerals as cumulates. Tectonic forces subsequently tilted the formation so that formerly horizontal layers are now nearly vertical.

The platinum and palladium rich zone called the J-M Reef is located near the bottom of the tilted complex above the chromite-rich zones. The J-M Reef and some of the chromite beds can be traced for the full length of the exposed complex. The depth of these features is not known, but geophysical studies and outcrops of similar rocks to the north suggest that they could continue for several miles.

The Stillwater Complex contains concentrations of chrome, copper, nickel, and iron minerals which have periodically drawn the interest of a variety of mining companies. Generally, the concentrations of these elements is not high enough to warrant commercial development considering current prices and technology, but the resources are significant and may be important for national security reasons. Chrome was mined during the two world wars from the Benbow and Mouat mines in the Stillwater River valley, and the Fish Mine in Main Boulder River valley until the Department of Defense was able to secure the sea lanes to ensure the supply from South Africa, which remains our major source of chrome.

### 3.5.1 Geologic History

The rocks stratigraphically below the Stillwater Complex (to the south) are over 3.0 billion-year-old sedimentary rocks that have been metamorphosed into hornfels and quartzite. These rocks contain some layers with fairly high levels of iron in the form of magnetite and ferro-magnesium silicates. The magnetite apparently influences compasses, making compass readings unreliable in the area. The main access road into the Picket Pin and East Boulder Plateau was constructed by United States Steel during the late 1950s to explore this iron formation.

The sedimentary rocks stratigraphically above the complex provide clues that allow geologists to unravel some of the recent geologic history. Approximately 3.0 billion years ago, the sedimentary pre-Cambrian (basement) rocks were intruded by magma that slowly cooled to form the Stillwater Complex. The heat from the magma metamorphosed or altered the older rocks, causing them to crystallize and form different chemical compounds. The intruding magma body formed a large lens or sill in the sediments. Geologists estimate that this sill was about 12,000-feet deep and covered at least 100 square miles. About 2.7 billion years ago, the Stillwater Complex was itself intruded by quartz monzonite rocks and then about 1.7 billion years ago intruded by mafic (relatively low silica content) dikes.

The area became faulted, folded, and tilted toward the north by the middle Cambrian (550 million years ago). The overlying sediments and some of the complex were eroded away before the land subsided, and the area became flooded by the ocean that covered most of the central portion of North America. During the next 450 million years, approximately 10,000 feet of sediment accumulated until the landforms started raising during the Laramide Orogeny, which created the Rocky Mountains during the Middle to Late Cretaceous (about 100 million years ago). Mountain building continued for about 50 million years.

During the mountain building process, the landforms were folded and faulted, resulting in some complex geologic structures. Erosion has removed most of the sediments, exposing the basement and Stillwater Complex rocks. During recent times, glaciers and rivers have sculpted the area, depositing alluvium, glacial till, and moraines in the valley bottoms and sides.

### 3.5.2 Regional Geology

The geology and geography that we see exposed today is a consequence of the tectonic (mountain building), erosional (mountain reducing), and depositional history of the area. Figure 2.3-1 is a simplified geologic map showing the major geologic and geographic features.

The Absaroka-Beartooth Mountains are the erosional remnants of the great mass of sediments and igneous intrusives that were uplifted during the late Cretaceous or early Tertiary time. On the north face of the mountains, Paleozoic and Mesozoic sedimentary rocks are upturned steeply against the intrusive igneous pre-Cambrian Stillwater Complex rocks. The upturned Madison limestone formation forms the prominent palisades along the Beartooth front. The front of the mountain range is formed by several thrust faults that have lifted the older pre-Cambrian rocks against and over the younger Paleozoic sediments.

The Stillwater intrusives abut the metamorphosed sediments labeled as basement rocks, or pre-Cambrian rocks, on the figures. These basement rocks form most of the Beartooth and East Boulder Plateau. Uplift has permitted erosion to remove the younger sediments exposing these ancient basement rocks. Younger volcanic rocks appear further south towards Yellowstone National Park. Plutonic quartz monzonite (similar to granite) intruded the western portion of the complex, cutting out the metamorphic basement rocks.

### 3.5.3 Stillwater Complex Geology

The Stillwater Complex has been divided into stratigraphic zones, each zone representing a different proportion of cumulus minerals. The division is graphically illustrated in Figure 2.3-1 which shows the nomenclature used by various geologists and the relative proportion of the various minerals in each zone.

The zones of economic interest are the Peridotite zone of the Ultra Mafic series, which hosts up to nine different chromite layers and the troctolite-anorthosite zone of the lower banded series that hosts the platinum-palladium sulfides.

#### 3.5.3.1 Stillwater Complex Mineralogy/Petrology

The rocks found in the Stillwater Complex contain varying amounts of iron (Fe), magnesium (Mg), manganese (Mn), calcium (Ca), silicon (Si), and chromium (Cr). The minerals that crystallized out of the magma depended highly on the temperature and the composition of the magma. For example, experiments show that olivine, crystallized from a silicate melt, would react with residual liquid melt as temperature slowly decreased to form pyroxene. If water is present, the pyroxene may then react with residual magma at still lower temperatures to form amphibole. This complexity of factors is why there is such a wide range of mineral assemblages in the complex. The most common minerals found are:

**Plagioclase**, a group of feldspars whose chemical formula ranges from albite, which is $NaALSi_3O_8$, to anorthite, $CaAl_2Si_2O_8$, with various combinations in between. The term anorthosite is commonly used to describe the plagioclase-rich rocks in the Stillwater Complex.

**Olivine**, an olive green, grayish green, or brown mineral: $(Mg,Fe)_2SiO_4$. It is a common rock forming mineral that crystallizes early from a magma, weathers easily, and metamorphoses to serpentine.

The gem peridot is a transparent green olivine crystal, and peridotite is a type of rock rich in the olivine mineral.

**Orthopyroxene**, is a sub-group of minerals within the general class of pyroxene minerals. Pyroxenes are a group of dark rock-forming silicate minerals having the general chemical formula $(Ca,Na,Mg,Fe^{+2})$, $(Mg,Fe^{+2},Al)Si_2O_6$. Different minerals form as the ratio of the constituent ions or elements change. Typical orthopyroxenes in the Stillwater include hypersthene and bronzite.

**Clinopyroxene** is the more common chemical and crystal form of clinopyroxene, the other class of the pyroxene minerals. Clinopyroxenes have less iron and magnesium than the orthopyroxenes; Augite's general mineral formula is $(Ca, Na)(Mg,Fe,Al)(Si\text{-}Al)_2O_6$.

These minerals are all somewhat similar chemically in that they belong to a general class of minerals known as Silicates, but as the temperature and composition of the magma changed, various combinations of the minerals crystallized out of the melt. Since the same minerals are found in different layers, geologists theorize that the temperature or composition of the magma must have changed periodically as a result of crystal settling or flotation. A possible explanation is that periodic injections of fresh magma occurred during the cooling. Some geologists believe that the J-M Reef ore zone resulted when newly injected magma reacted with the partially separated magma to form an immiscible (physically separate from the rest of the magma) sulfide liquid which cooled to form the ore zone.

The Stillwater Complex has been divided into three or four zones which have been further subdivided into members. These zones are relatively continuous throughout the complex. The prevailing system is to divide the complex into the following three zones, listed from the bottom up:

**Basal zone.** The 535-foot-thick basal zone is in contact with the basement rocks and has metamorphosed those rocks into hornfels which is a fine-grained metamorphic rock composed of a mosaic of crystals of equal size and shape without any preferred orientation. The basal unit cuts through and into the basement rocks.

Although the cumulates of the basal zone are internally complex and vary laterally, they can be broadly grouped into a bronzite member near the top and a norite zone immediately above the basement rocks. Norite is a mixture of bronzite and plagioclase feldspar. The bronzite member consists mostly of orthopyroxene cumulate and contains occasional lenses of chromite.

**Ultra mafic zone.** Ultra mafic is a general name given to dark colored plutonic rock. The 6,000-foot-thick zone is composed of cumulates of olivine, bronzite, and chromite. It generally overlies the basal zone but in places is in direct contact with basement rocks. The zone is composed of between 8 to 20 cycles of an alternating succession of olivine-chromite-bronzite cumulate layers. Some of the chromite layers have been traced over the full-length of the Stillwater Complex.

**Banded zone.** This zone makes up over three-fourths of the Stillwater Complex and is the most difficult zone to classify stratigraphically. It is characterized by plagioclase-rich rocks with alternating layers containing plagioclase, clinopyroxene, orthopyroxene, and olivine. Geologists have subdivided the zone into lower, middle, and upper series based on the ease of recognizing and field mapping the contacts between the zones.

The Lower Banded Series contains the platinum and palladium rich J-M Reef which is located 1,400 feet above the base of the zone. The name "Reef" was used here because the platinum occurrences in the Stillwater Complex are similar to occurrences in South Africa, which are termed "reefs" or "saddles."

The Middle Banded Series - A thick plagioclase cumulate known as anorthosite lies stratigraphically above the olivine bearing cumulates at the top of the lower banded zone. It has been mapped continuously along the length of the Stillwater Complex and forms the base of the middle zone. A complex package of plagioclase-olivine-bronzite-augite (clinopyroxene) bearing cumulates forms the bulk of the middle zone, which is capped by another plagioclase rich anorthosite at the top. A sulfide bearing interval containing anomalously high concentrations of platinum group elements occurs near the top of this zone and is referred to as the Picket Pin Deposit.

The Upper Banded Series - The bottom of the upper series is marked by a thin sequence of olivine-bearing cumulates which overlay the anorthosite. Above this lies a complex consisting primarily of pyroxene-rich gabbro, which is a mixture of plagioclase and pyroxene minerals.

Geologists do not fully understand how the Stillwater Complex and other layered intrusions formed and why the minerals are found in the cyclic layers. The process is believed to be extremely complicated.

### 3.5.4 Structural Geology

The two main types of faults within the proposed mine are steeply dipping strike-slip faults which cross the J-M Reef and reverse faults which tend to parallel the reef. Over-thrusting (low-angle reverse faulting; rocks are pushed up and over other rocks) is common in the eastern portion of the complex.

The strike slip faults (in which fault blocks or bodies of rock move in opposite directions laterally along a fracture) influence the mine planning because they break the ore body into 1,000 to 1,300-foot long discrete blocks with 80 to 85-foot offsets. The reverse faults, also mapped as thrust faults, cross the major drainages and are the part of mechanism resulting in the uplifting that created the Beartooth Plateau. When the underground mining crosses faults that intersect drainages or streams, some of the water might travel down the fracture system into the mine.

The main adit will be driven through the Brownlee Creek fault and several other unnamed parallel faults which cross local drainages.

The Stillwater Complex geologic structure is fairly complex, especially near the major faults. Much of the structure is concealed by surficial deposits, making detailed descriptions difficult.

Beak (1982d) reports the rock joint density averages 1.5 joints per square foot. The direction of the joint set varies about 60° between the mill site and J-M Reef, suggesting that the joints were caused by several different tectonic events.

### 3.5.5 Surficial Geology

Glaciers covered portions of the Dry Fork and East Boulder River valley and some of the tributaries during the Pleistocene. The glaciers deposited large quantities of material in the valley bottom, ranging in size from clay to boulders. These glacial moraines can be seen near the proposed mill and adit site and at the bottom of the Dry Fork and will form the foundation beneath the proposed tailing disposal area. Geotechnical studies by various consulting firms show that the engineering characteristics of the glacial deposits is highly variable, but overall they form a good foundation for the tailing pond and mine facilities.

Very little alluvial deposition has taken place on the plateau. Some small alluvial fans have been deposited over the glacial moraines along the East Boulder River valley. Large quantities of alluvium have been deposited in the Dry Fork Valley, both above and beneath the glacial deposits.

Talus covers a large portion of the valley walls, and there is evidence of large mass failures or landslides in the East Boulder River and Dry Fork valleys, but none appear recent. Recent slumping is evident in some of the glacial sediments in the lower East Boulder River valley several miles downstream from the project.

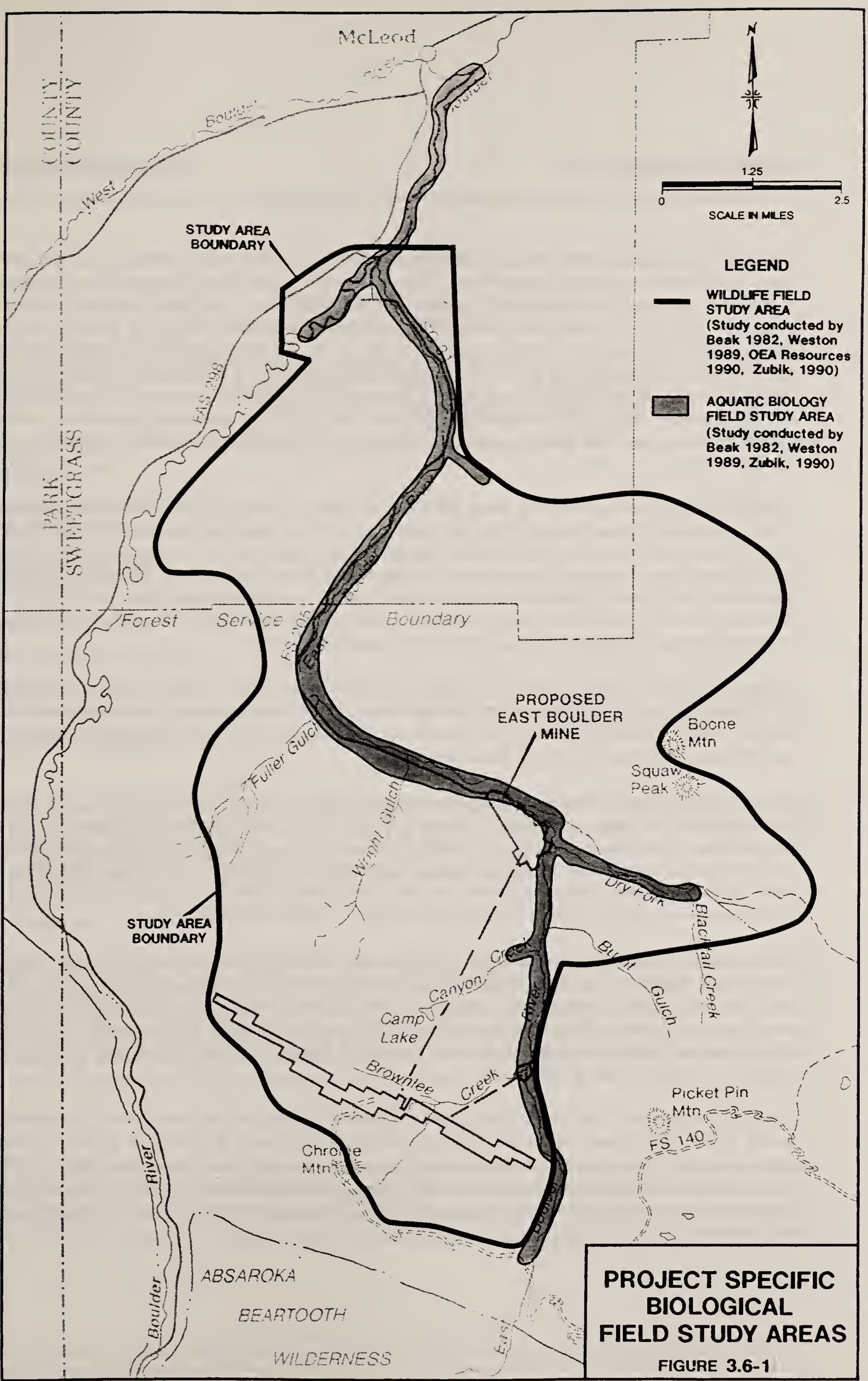
## 3.6 WILDLIFE

Previously completed baseline biological studies of the study area (provided by SPGMR) include wildlife studies completed by Montana Department of Fish, Wildlife, and Parks (MDFWP) (Rosgaard and Simmons 1982), Beak Consultants (Beak 1983b), follow-up studies by Weston and Western Technology and Engineering, Inc. (1989) and OEA Resources (1990). Additional baseline information has been provided by GNF (Zubik 1990b). Wildlife ground surveys focused on the East Boulder permit area, while aerial surveys and grizzly component mapping covered a much larger area in the East Boulder River valley (to the confluence with the Main Boulder River) and East Boulder Plateau. The wildlife field study area is presented in Figure 3.6-1.

### 3.6.1 Habitat Types

During their baseline biological studies in 1982, Beak Consultants identified eight primary wildlife habitat types within the study area, including alpine; subalpine; montane forest; aspen; riparian; grassland; agriculture; and cliffs, rocky outcrops and scree (Beak 1983b). These types are typical for the northern Rocky Mountains. Each of these is described below.

Alpine tundra habitat occurs above approximately 9,850 feet in southeastern Montana and includes features such as snowbanks, wet meadows, dry meadows, hummocks, and fellfields. Characteristic species include grey-crowned rosy finch and water pipit.




**PROJECT SPECIFIC BIOLOGICAL FIELD STUDY AREAS**

FIGURE 3.6-1

Subalpine habitat occurs from roughly 6,500 feet to 9,500 feet, between the montane forest and timberline. Most of this habitat consists of conifer forest. The dominant tree species are Douglas-fir and lodgepole pine in the lower subalpine, and subalpine fir, spruce, and whitebark pine in the upper subalpine and timberline transition. The Placer Basin permit area is located primarily in upper subalpine habitat, and the East Boulder permit area in lower subalpine habitat (Table 3.6-1). A portion of the East Boulder permit area was clearcut in the summer of 1990. The Placer Basin permit area is dominated by wind-stunted conifer forests interspersed with meadows and rock. Common or characteristic subalpine species include ermine, marten, northern three-toed woodpecker, dark-eyed junco, evening grosbeak, pine siskin, red-breasted nuthatch, Stellars jay, and gray jay. Most of the species listed below for montane forest also occur in subalpine areas.

Montane conifer forest occurs from about 5,800 feet to 7,800 feet elevation in the study area, including most of the area along the East Boulder River and south slope of Long Mountain from the GNF boundary to Dry Fork. The habitat type is not present within the permit area, but is prevalent along the access road within the National Forest. Montane forest includes a number of different habitat types, dominated by limber pine, Douglas-fir, and spruce. Common or characteristic species include snowshoe hare, red squirrel, golden-mantled ground squirrel, bobcat, Clark's nutcracker, black-capped chickadee, Swainson's thrush, red crossbill, and warbling vireo, as well as the species listed for subalpine habitat.

Aspen habitat occurs only in a limited, scattered portion of the study area, within the East Boulder and Dry Fork montane forest. This habitat type provides water, cover, breeding areas, and nesting sites for many wildlife species, including ruffed grouse, Empidonax flycatchers, and numerous songbirds. Aspen sprouts may be heavily browsed by elk and mule deer.

Riparian habitat occurs primarily as narrow corridors adjacent to the East Boulder River, Dry Fork, lower Brownlee Creek and major tributaries. It primarily includes bottomland hardwood communities at the lower elevations, and wet spruce habitats at middle elevations. The portion of the Placer Basin permit area included as riparian in Table 3.6-1 is a mosaic of open water, wet meadow, and forest. Numerous species occur in riparian habitat, including beaver, raccoon, mink, white-tailed deer, moose, red fox, ruffed grouse, great-horned owl, yellow warbler, McGillivrays warbler, mallard, and dipper.

Areas mapped as grasslands, including sagebrush and grassland communities, primarily occur below 7,000 feet within the study area. Grassland is frequently grazed by livestock, and is important habitat for mule deer and various raptor species. Pronghorn antelope were observed by Weston (1989) in grasslands along the Main Boulder River from its confluence with the East Boulder River near the Natural Bridge. Other grassland species include white-tailed jackrabbit, badger, Richardson's ground squirrel, western kingbird, and sharp-tailed grouse.

Most agricultural land in the study area is used for livestock grazing or hay production. The habitat occurs mainly in the broad lower valley of the East Boulder River, where it is crossed by the proposed and alternative road corridors. The agricultural habitat type is generally similar to grassland in wildlife use. Mule deer are common in agricultural fields year-round especially during the winter. White-tailed deer use agricultural land near stream bottoms year-round. Other species include norther harriers, magpies, grackles, and cowbirds.

TABLE 3.6-1

APPROXIMATE AREA OF
WILDLIFE HABITAT TYPES IN permit areaS

| | East Boulder Permit Area (Acres) | Placer Basin Permit Area (Acres) | Brownlee Creek Permit Area (Acres) | Total (Acres) |
|---|---|---|---|---|
| Subalpine Forest | 254 | 157 | 3 | 414 |
| Subalpine Forest/Meadow/ Rock Mosaic | | 182 | | 182 |
| Rock/Subalpine Forest Mosaic | | 219 | | 219 |
| Riparian | | 16 | | 16 |
| Cliffs, Rocky Outcrop, Scree | 6 | 6 | 1 | 13 |
| TOTAL | 260 | 580 | 4 | 844 |

Source: OEA Research 1990

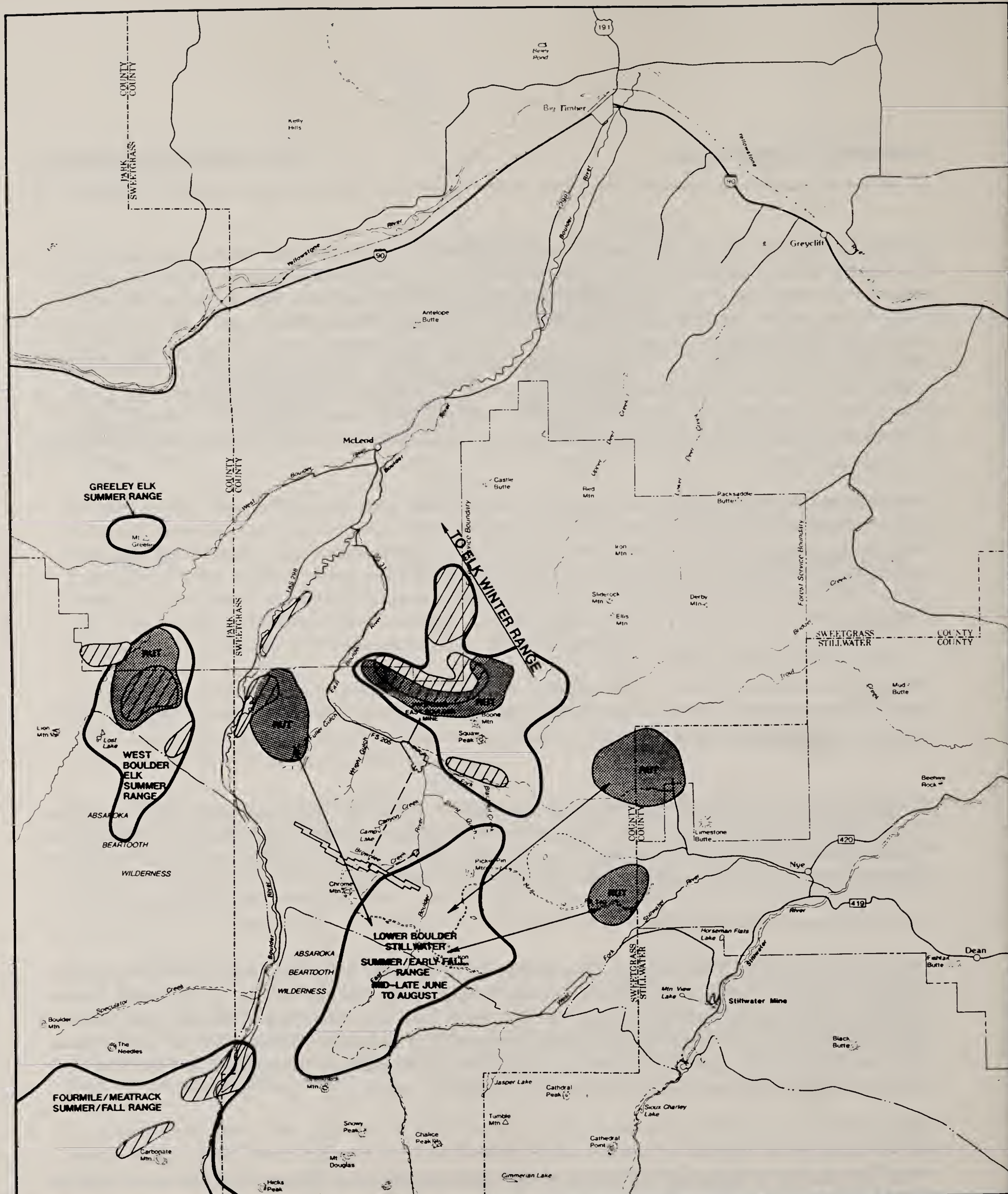
Cliffs, rocky outcrops, and scree habitat is distinguished by its physical features and sparse vegetation. This type occurs at middle and higher elevations within the study area, including portions of all three permit areas. These areas are used for nesting by various raptor species, swifts, swallows, and ravens. Pikas and yellow-bellied marmots are found almost exclusively in boulder fields.

**3.6.2 Important Wildlife Species**

Big game species found in the study area include elk, mule deer, white-tailed deer, moose, black bear, bighorn sheep, and mountain lion. Threatened and endangered species and other species of special concern are discussed separately in Section 3.6.3. Seven species have been identified as management indicator species within GNF. Of these, one is an aquatic species and is discussed in Section 3.7, two are threatened or endangered species (grizzly bear and bald eagle) and are included in Section 3.6.3, and the other four (elk, goshawk, marten, and hairy woodpecker) are discussed below.

Elk

The distributions of important elk habitat in the region are shown in Figures 3.6-2 and 3.6-3. Elk are uncommon within the East Boulder River bottom near the portal site, which is primarily transitional range between winter and summer ranges, and calving and breeding areas (Beak 1983b; FS 1990b). There is some spring and fall elk movement through the East Boulder River drainage from summer to winter range. The




## LEGEND

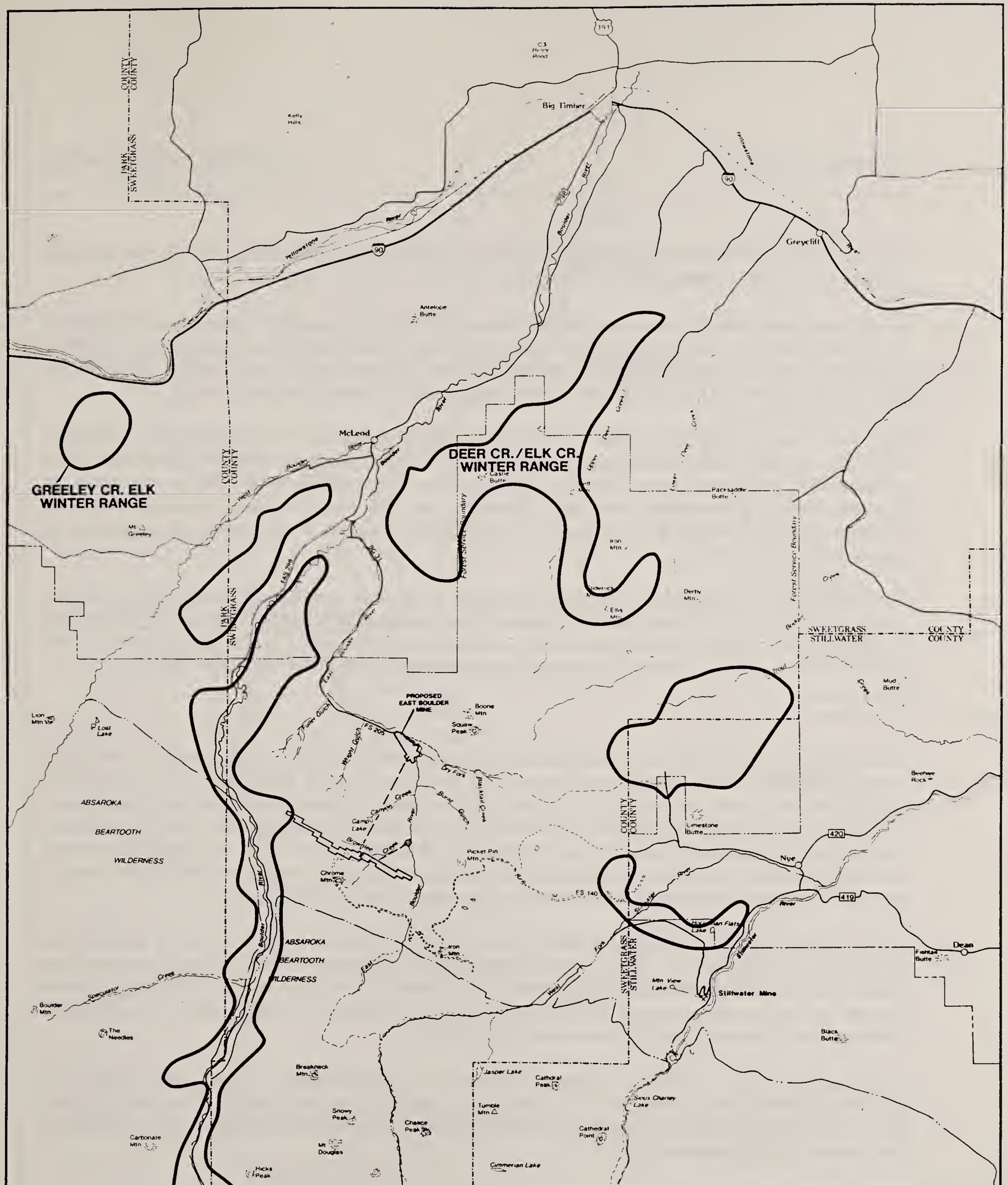
- ELK SPRING/SUMMER/FALL RANGE
- ELK CALVING AREA
- RUT — ELK RUTTING AREA
- ← ELK MIGRATION ROUTES (Exact drainages unknown)

SOURCE: GALLATIN NATIONAL FOREST

0 1.25 2.5 SCALE IN MILES

## ELK CONCENTRATED USE AREAS (SPRING/SUMMER/FALL)

FIGURE 3.6-2




LEGEND

ELK WINTER RANGE

SOURCE: GALLATIN NATIONAL FOREST

SCALE IN MILES

## ELK CONCENTRATED USE AREAS (WINTER)

FIGURE 3.6-3

forested area of the East Boulder permit area itself may provide security habitat for elk, but currently contains little forage to attract elk for extended use.

Other nearby areas provide more important elk habitat. The Dry Fork, starting about one-quarter mile east of the East Boulder permit area, is used as summer/fall range for about 40-50 elk in most years (FS 1990b). Calving also occurs in early spring on the upper Dry Fork. The area on the north side of Long Mountain about one mile north of the East Boulder permit area is used for both calving and rutting.

The eastern portion of the Placer Basin permit area is included in summer/early fall range for a population of 150-200 elk which winter in the lower Main Boulder River valley and for an additional population which winters (GNF 1990) in the Meyers Creek and Stillwater River drainages (FS 1990b). Elk populations in the Absaroka-Beartooth Mountains have been increasing over the past ten years (Simmons 1990). A management goal of Montana Department of Fish, Wildlife and Parks is to maintain elk populations at current levels (FS 1990b).

The study area lies within Region 5, hunting district 560. The average hunter success percentage for the five year period 1985-1989 for the district is 16.8 percent. The average elk harvest for the same period is 91 elk. There has been a steady increase in the number of elk harvested for hunting district 560 from 1985 to 1989 (MDFWP 1990). Elk are listed as a big game indicator species by the GNF plan (FS 1987a).

Mule Deer

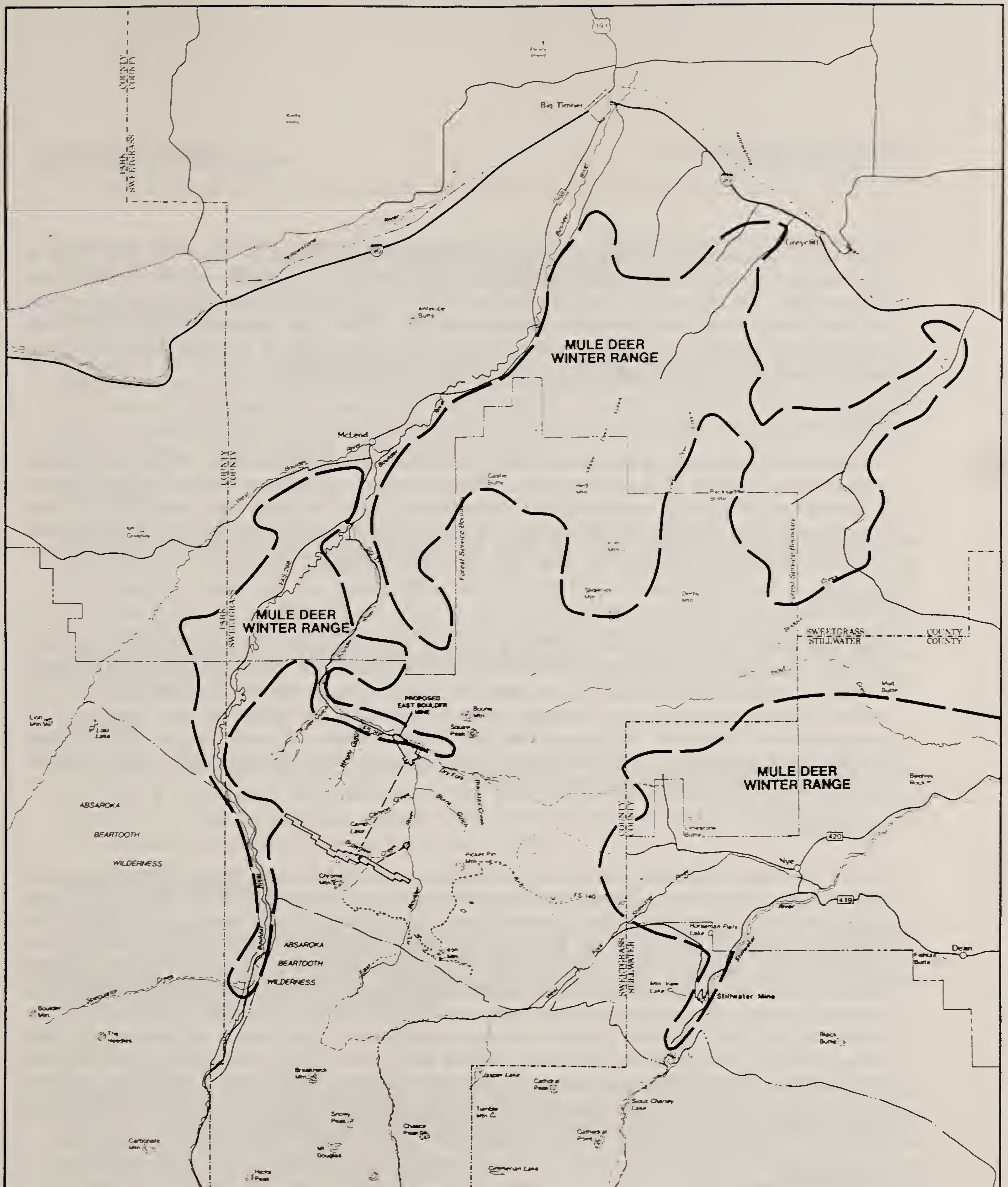
Mule deer are the most numerous big game species in the study area (Beak 1983b; Weston 1989). The mapped area of mule deer winter range (Figure 3.6-4) in the East Boulder River valley covers a portion of the East Boulder permit area, and about six miles of access road to the mine site. In the early 1980's, about 150-200 mule deer wintered in the lower East Boulder River drainage on the forest (FS 1990b), but numbers have been declining in recent years. Mature Douglas-fir stands in the lower ends of the drainages provided critical winter habitat including snow/thermal cover and browse forage. Some mule deer also wintered in the lower Dry Fork drainage and relied heavily on the same Douglas-fir habitat type.

The East Boulder permit area is also used by mule deer spring to fall. The Dry Fork is an important summering area for mule deer from several winter ranges (FS 1988). Summer/fall mule deer use also occurs on the East Boulder Plateau (Zubik 1990b). The number of mule deer has been declining somewhat through the region in recent years due to increasing elk and mountain lion populations, and a general deterioration of habitat due to fire suppression (FS 1990b).

An average of 640 mule deer were harvested each year from hunting district 560 during the period of 1985 to 1989 (MDFWP 1990). About 15 to 20 deer were taken from the East Boulder River and Dry Fork valleys. MDFWP's management goal for mountain mule deer is to maintain or slightly increase populations over current levels (Simmons 1990).

White-Tailed Deer

White-tailed deer are found year-round along the lower East Boulder and Main Boulder Rivers, primarily associated with riparian habitat (Beak 1983b; Weston 1989). During the summer and fall, they occur in limited numbers along the East Boulder River as far as the Dry Fork (FS 1990b). In 1989, Weston biologists




**LEGEND**

MULE DEER WINTER RANGE

SOURCE: GALLATIN NATIONAL FOREST

1.25
0 2.5
SCALE IN MILES

**MULE DEER CONCENTRATED USE AREAS (WINTER)**

**FIGURE 3.6-4**

found white-tailed deer near Anderson Springs at the GNF boundary, and in the lower Dry Fork Creek in the spring and summer, and reported that the East Boulder permit area probably receives occasional use (Weston 1989). On the forest, white-tailed deer are closely tied to stream bottoms in riparian zones that have good security cover and productive foraging areas (FS 1990b). The white-tailed deer population is expanding in both numbers and distribution on the GNF. An average of 145 white-tailed deer were harvested each year from hunting district 560 during the 1985-1989 period.

Moose

Small numbers of moose are present in the vicinity of the East Boulder permit area. Moose are generally confined to the Dry Fork drainage, but evidence of moose has been found along the East Boulder River in the narrow band of spruce located there (Beak 1983b; Weston 1989). The Placer Basin permit area contains a few moose that may winter in the Main Boulder River drainage (FS 1990b). Moose numbers in this region are low compared to 20-30 years ago (FS 1990b), but currently appear to be on the rise (Simmons 1990).

Black Bear

Black bear studies conducted by the MDFWP in the early 1980's in the East Boulder River and Dry Fork drainages found these areas to be important spring concentration areas for black bears (Weston 1989). During the spring the open meadows, aspen stands, and riparian areas provide important feeding areas. Use continues through the summer until denning, although populations are reduced as some bears move to higher elevations. Black bear also occur on the East Boulder Plateau and heavily use the whitebark pine cone production in good years. A collared female black bear spent two consecutive winters on the mountain above the East Boulder permit area (Weston 1989).

Bighorn Sheep

Bighorn sheep may occasionally occur within the study area on the East Boulder Plateau. Historically, small bands of bighorn sheep were scattered throughout the Beartooths, but they have mostly disappeared. One population (Nye herd) winters in the Stillwater River Valley southeast of the study area. MDFWP has recently found bighorn sheep from this herd using the West Fork of the Stillwater River around Iron and Crescent Creeks, only a few miles southeast of the Placer Basin permit area (Zubik 1991). The Nye herd is currently at a very low population level. Occasional bighorn sheep, probably from the Nye herd, have also been seen at several other locations near the study area, including Chrome Mountain, Boone Peak, and the head of the Dry Fork. Another population occurs in the Haystack Peak area at the head of the Main Boulder drainage, well outside the study area. Bighorn sheep have recently been introduced into the Mill Creek and Main Boulder River drainages outside the GNF boundary. Radio-collared sheep from the Main Boulder River plant have been found in the study area on Contact Mountain, head of Graham Creek, and head of Wright Gulch. This population has been greatly reduced for unknown reasons.

Mountain Lion

Mountain lions were not observed in the study area during the 1982 Beak studies, but tracks were found near the study area and in Dry Fork in 1989 (Weston 1989). Mountain lions summer throughout the study area in small, isolated numbers because of their wide ranging, territorial nature tied closely to their prey, including mule deer (USFS 1990). Regional mountain lion populations have increased during the 1980's

(Simmons 1990). MDFWP data indicate an average of seven mountain lions are harvested annually in hunting district 560, two of which come from the East Boulder River area (Zubik 1991).

Upland Game Birds

Blue grouse are found in scattered numbers at higher elevations in the study area; however, no population estimates are available (FS 1990b). They typically winter in conifer forests at high elevations and move to open, lower elevation habitats in the spring. Ruffed grouse are found in scattered numbers generally at lower elevations in riparian zones and aspens stands (FS 1990b). Grouse populations and distribution in the study area appear to be typical for the region (Beak 1983b).

Pine Marten

This species is a GNF indicator species for old growth forest, especially moist spruce sites (FS 1987a). Little is currently known about the population within the study area, although they are known to occur in the Placer Basin area and in the East Boulder River valley (USFS 1990). None of the permit areas appears to have mesic old growth and mature forest in the spruce/fir zone which are considered to be optimal habitat for this species. According to MDFWP records, about 20-30 pine marten are trapped annually in Region 5, mostly in hunting district 560, which includes the Main Boulder River, East Boulder River, and East Boulder Plateau (Zubik 1991).

Goshawk

This species is also a GNF indicator species for old growth forest, especially dry Douglas-fir sites (FS 1987a). Very little is known about their occurrence in this area, although they have been sighted by MDFWP personnel in the East Boulder River drainage (USFS 1990), and were reported by Beak (1983b) as one of the most commonly observed raptor species in the study area.

Waterfowl and Shorebirds

Suitable habitat for waterfowl and shorebirds appears to be limited to the East Boulder and Main Boulder Rivers. Although 74 species were identified by Beak (1983b) as potentially occurring in the study area, only five species were observed during their field surveys. These species include great blue heron, Canada goose, mallard, spotted sandpiper, and least sandpiper.

Raptors

Fourteen species of raptors and nine species of owls are known to occur on the GNF (FS 1987b). Of these, 11 species were observed during the 1982 Beak surveys (Beak 1983b). Northern harrier, rough-legged hawk, ferruginous hawk, Swainson's hawk, prairie falcon, and American kestrel were observed primarily over agricultural fields and grasslands. Great-horned owls were observed in wooded riparian habitats, and goshawks, red-tailed hawks, and golden eagles were observed over a variety of habitat types. A golden eagle nest located near the GNF boundary was active in 1981, but not in 1982 (Beak 1983b) nor 1989 (Weston 1989). An intensive survey for raptors nests by Beak in 1982 found two additional inactive golden eagle nests, but no active raptor nests in the study area.

### 3.6.3 Threatened, Endangered, and Sensitive Species

Species of special concern include species listed as endangered or threatened by the U.S. Fish and Wildlife Service, those under review (category 1 and 2) for endangered or threatened status, species listed as sensitive by the Northern Region of the U.S. Forest Service and GNF, and species considered sensitive by the Montana Natural Heritage Program. Table 3.6-3 provides a list of 24 species of special concern which are known or suspected of occurring in the study area. This list has been updated since the release of the draft EIS in May 1991; 3 Gallatin National Forest sensitive species have been added. Further information on threatened and endangered species can be found in the Biological Assessment for the East Boulder Mine Project, published in May 1991 (See Appendix D). In a letter dated June 14, 1991, the U.S. Fish and Wildlife Service concurred with the findings of the Biological Assessment. There has been no change in status of the threatened and endangered species addressed in this Biological Assessment, therefore, no update has been necessary.

Bald Eagle

The number of nesting bald eagles has been on the rise throughout Montana since 1980 (Weston 1989). Bald eagles winter along the Yellowstone and Main Boulder Rivers. They have been spotted in the winter months along the East Boulder River north of the GNF boundary. The nearest known nesting site is along the Yellowstone River (Flath 1990). The riparian corridor along the lower Main Boulder River probably contains suitable nesting habitat, but the upper Main Boulder and East Boulder Rivers are probably not large enough to provide sufficient prey. Bald eagles feed on fish, waterfowl, and carrion, and they appear to use the East Boulder River and general study area in the winter season for occasional foraging based on number of sightings in recent years (Weston 1989). Heavy ice on the East Boulder River during the winter may prevent it from being used as a primary food source (Beak 1983b).

Peregrine Falcon

Historically, peregrine falcons were known to inhabit the study area. They nest in high cliffs, generally within a mile of a river or stream. They usually occupy the same territory from year to year. Potentially suitable habitat exists along the Main Boulder and East Boulder Rivers. Since 1981, peregrines have occurred in Montana (Weston 1989). Peregrine chicks were hacked and fledged in 1989, 1990, and 1991 at a hack site approximately five miles from the study area (Flath 1990, and Orr 1992). Peregrine numbers are expected to increase due to the hacking program. If numbers do increase, the potential exists for the peregrine to settle in the study area.

Grizzly Bear

Occasional sightings of grizzly bear, mostly unconfirmed, have been reported in the study area, indicating that transient bears use the area on a limited basis (Beak 1983b; Weston 1989). The bears are part of the Yellowstone National Park population, which is considered to be expanding outward from the park (Amato & Whittemore 1989). The study area and surrounding environment contain habitat types favored by the grizzly bear, according to habitat maps developed by Gallatin and Custer National Forests. However, the East Boulder permit area is part of Management Situation 5, which means grizzlies do not occur or occur but rarely in the area (FS 1987a).

TABLE 3.6-3

ENDANGERED, THREATENED, AND SENSITIVE WILDLIFE SPECIES KNOWN OR POTENTIALLY OCCURRING IN THE STUDY AREA

| Species | US Fish and Wildlife Service[a] | US Forest Service Northern Region[b] | Montana Natural Heritage Program[c] | Montana Status[d] |
|---|---|---|---|---|
| Mammals | | | | |
| Gray wolf | LE | E | S1/G4 | E |
| Black-footed ferret | LE | - | SH/G1 | E |
| Wolverine | C2 | - | S4/G4 | FBRH |
| Grizzly Bear | LT | T | S3/G4 | GARH[e] |
| Western big-eared bat | C2 | S | S2/G4 | NG |
| Eastern small-footed myotis | C2 | - | S3/G3 | NG |
| Lynx | C2 | S | S3/G5 | FBRH |
| Preble's shrew | C2 | - | S3/G4 | NG |
| Birds | | | | |
| Peregrine falcon | LE | E | S1/G3 | E |
| Bald eagle | LE | E | S3/G3 | E |
| Boreal owl | - | S | S3/G5 | P |
| Burrowing owl | - | - | S3/G5 | P |
| Flammulated owl | - | S | SU/G4 | |
| Great grey owl | - | - | S3/G5 | P |
| Ferruginous hawk | C2 | S | S3/G4 | P |
| Common loon | - | - | S3/G5 | P |
| Trumpeter swan | - | S | S2/G4 | MB |
| Harlequin duck | - | S | S2/G5 | MB |
| Mountain plover | C2 | - | S2/G3 | P |
| Long-billed curlew | C2 | - | S4/G5 | P |
| White-faced ibis | C2 | - | S1/G5 | P |
| Black-backed woodpecker | - | S | S5/G5 | |
| Fish | | | | |
| Yellowstone cutthroat trout | - | S | S2/G5T3 | GF |
| Westslope cutthroat trout | - | S | S3/GST3 | |

TABLE 3.6-3
(Concluded)

Notes

[a] Federal status (USFWS):
- LE = Listed endangered
- LT = Listed threatened
- C2 = Under review for listing as threatened or endangered, current information indicates that listing may be appropriate but further information is required.

[b] U.S. Forest Service status:
- E = Endangered
- T = Threatened
- S = Sensitive species
- W = Watch list

[c] Montana Natural Heritage Inventory:
- S1/G1 = Critically endangered in Montana/throughout range
- S2/G2 = Endangered in Montana/throughout range
- S3/G3 = Threatened in Montana/throughout range
- S4/G4 = Apparently secure in Montana/throughout range
- S5/G5 = Demonstrably secure in Montana/throughout range
- SU/G4 = Possibly imperiled, status uncertain; more information required.
- SH = Historically known in Montana; may be rediscovered
- T = Rank for a subspecies or variety, appended to the global rank for the full species.

[d] Montana status:
- FB = Fur bearing animal
- MB = Migratory bird
- E = Endangered
- P = Protected species
- RH = Restricted harvest
- NG = Nongame wildlife
- GA = Game animal
- GF = Game fish

[e] Not hunted in the Greater Yellowstone Ecosystem

Source: Montana Natural Heritage Program 1990; USDA Forest Service 1989a; U.S. Fish and Wildlife Service 1989.

Gray Wolf

The Greater Yellowstone area, and most of Montana, were once part of the gray wolf range. Confirmed sightings of the gray wolf in the study area have not been made in decades (Weston 1989). The nearest self-sustaining population of the gray wolf is in Glacier National Park. Plans for reintroducing the gray wolf into Yellowstone National Park have been underway for many years, but at this time no decision has been made. It is unlikely the gray wolf occurs in the project area. However, if reintroduction occurs, it is possible they could move into the area in the future.

Harlequin Duck

This species is a GNF-listed sensitive species, for which field surveys were conducted on the forest in 1990 (Markum 1990). Harlequin duck are known to prefer isolated, swift-flowing mountain streams for breeding. They winter on the coasts, mainly in the Aleutians. The 1990 study of distribution and abundance of the species on the GNF included all of the potential harlequin duck breeding habitat identified on the forest. Harlequin duck were only recorded on the upper Main Boulder River, about ten miles southwest of the East Boulder permit area which appears to be the edge of the known range. Harlequin ducks were not observed on the East Boulder River during this study, and have not been previously observed there. However, the study indicated that this river appeared to be the best candidate for occurrence of the 14 streams surveyed, because of its habitat features and absence of a road or trail running along its length.

Boreal Owl

Boreal owls live year round in high elevations (5,000 to 8,000 feet), in mature-to-old growth Engelmann spruce and subalpine fir forests. According to U.S. Forest Service timber data, this type of habitat is not present in or around the proposed East Boulder permit area (Timko 1990).

Western Big-Eared Bat

This species has been recorded in a variety of habitats ranging from dry pinyon-juniper woodland to high elevation mixed conifer forests (FS 1987a). They roost communally in large aggregations in caves and abandoned mine tunnels, and are extremely sensitive to human disturbance to winter roosts. Since their known distribution includes the study area, helicopter surveys to locate caves in or near the permit areas were made by GNF in 1990, but no natural caves were observed (Timko 1990, Zubik 1990b).

Other Species

A number of other special status species have been recorded in Sweet Grass County, or are suspected of occurrence in the study area, but there is little specific information available. Wolverine, lynx, and great gray owl are species of middle and higher elevations. One observation of a great gray owl and one of lynx was made during the Beak (1983b) surveys, and wolverine may be present as well. The preble's shrew, burrowing owl, ferruginous hawk, common loon, trumpeter swan, mountain plover, long-billed curlew, and white-faced ibis are mainly animals of lower elevation prairies and wetlands which could potentially occur along the access road and transmission line corridors. Black-footed ferret occurred historically in Montana. All known populations are in captivity but this species could potentially occur in prairie dog towns; however, no prairie dog towns have been identified in the study area.

## 3.7 AQUATIC ECOLOGY AND FISHERIES

The study area for aquatic biology includes a small portion of the Main Boulder River, the entire East Boulder River, and various tributaries to the East Boulder including Brownlee Creek, Canyon Creek, and Dry Fork (Figure 3.6-1). Field studies were conducted in 1981 and 1982 for SPGMR by Beak Consultants Inc. (1982f), and further studies were completed in 1989 by Weston to incorporate changes in the project plan and changes in the environment due to a timber sale near the project site. The studies included descriptions of stream habitat, periphyton/macrophytes, macroinvertebrates, fisheries, and sensitive species. Forest Service studies on aquatic biological resources are presented in (FS 1990b) and Zubik (1990b).

### 3.7.1 Stream Habitat

The lower portion of the current access road corridor crosses the Main Boulder River just upstream from the confluence with the East Boulder River. The Main Boulder River has an average width of 23 m, average depth of 1 m, average pool depth of 2 m, and an average gradient of 1 percent. Pools occupy about 15 percent of the river, runs 25 to 30 percent, and riffles 55 to 60 percent. The predominant substrate types are boulders and rubble. Potential trout spawning sites are limited in size and number. Channel stability is excellent and bank stability is good. The bank vegetation is deciduous with fair shade coverage.

The East Boulder River extends from the confluence with the Main Boulder River about 3 miles south of McLeod upstream to the Placer Basin area southeast of the Placer Basin permit area. About 13 stream miles are located within the GNF, and about 6 miles on private land north of the forest boundary. The East Boulder permit area is located near or adjacent to the East Boulder River for about one mile, the Brownlee Creek permit area is adjacent to the confluence of Brownlee Creek and the East Boulder River, and the access road corridor parallels the East Boulder River for about 10 miles. The section on the GNF is boulder-strewn with primarily pocket water for fish holding habitat and little suitable spawning grounds. Based on sampling data from five stations (Beak 1982f), the East Boulder River has a width ranging from 4 m to 12 m, a gradient from 1 to 4 percent, a river depth ranging to 0.1 m to 0.5 m, and a pool depth ranging from 0.5 to 1.0 m. Channel stability is good to excellent and bank stability is mostly good. Streamside vegetation consists of deciduous trees along the lower portion and conifer trees and shrubs further upstream. Habitat types include riffles, runs, and pools. Pools make up about 10 percent of the river except at the lowest station near the confluence with the Main Boulder River, where they are 33 percent; and runs and riffles average about 35 percent and 50 percent, respectively. The predominate substrate is boulder and rubble, except in pools at the lowest station where gravel and fines predominate. According to core sampling information collected by Weston (1990) just below the proposed mine site, existing instream fine sediment is minimal. Subsurface cover for fish is mostly fair. Stream shade cover ranges from poor to good. Occasional fallen trees span the river, but they do not appear to block fish passage. Overall, little woody debris is present in the river. The series of falls and cascades on the East Boulder River beginning about one mile downstream from the mouth of the Brownlee Creek act as a barrier to upstream fish migration.

The Dry Fork joins the East Boulder River just east of the East Boulder permit area. Except in the lower one-half mile, the Dry Fork is dry in late summer and fall of each year. Several small spring-fed ponds are located about one-eighth mile upstream from the mouth. The largest and deepest pond contains some fish habitat. Dry Fork is narrow and shallow, with an average width of 2.4 m, and average depth of 0.1 m, an average pool depth of 0.3 m, and an average gradient of 6 percent. Runs and riffles predominate, with substrate types being mostly boulders and rubble in riffles, and rubble and gravel in pools. Potential

spawning gravels are present. Channel stability is excellent and bank stability is good. Subsurface cover for fish is poor due to shallow depths; shade cover is excellent. A relatively large amount of woody debris is present in the creek due to conifer downfall (Beak 1982f).

Brownlee and Canyon Creeks are located upstream of the East Boulder permit area and downstream from the Placer Basin permit area. The Brownlee Creek permit area is located adjacent to the lower portion of Brownlee Creek. One sampling station was located near the mouth of each creek (Beak 1982f). Brownlee Creek had an average width of 2 m, an average depth of 0.1 m, and an average gradient of 28 percent. Canyon Creek was similar but somewhat narrower (average width 1.4 m, average depth 0.1 m, and average gradient 26 percent). The substrate is mostly boulder and rubble. The step-wise structure of riffles and pools prevents the upstream movement of fish into these streams from the East Boulder River. Portions of these creeks are dry in late summer. Camp Lake is located on Canyon Creek, about 2 miles above the mouth, and is approximately 10 acres in size.

The access road and utility corridor would cross Fuller Gulch, Wright Gulch, and Lewis Gulch. All are intermittent tributaries of the East Boulder River which lack resident fish populations (FS 1990b). No information on these creeks was reported by Beak (1982f).

### 3.7.2 Periphyton and Benthic Macroinvertebrates

Periphyton and benthic macroinvertebrate sampling was conducted at six stations on the Main Boulder and East Boulder Rivers by Beak (1982f).

Periphyton generic composition was found to consist entirely of diatoms. The greatest number of genera (17) was found in the lower East Boulder River in the fall. The fewest number of genera (6) was found in the upper portions of the river, also in the fall (Beak 1982f). Mean total periphyton densities were greater in the lower portion of the river than in the middle or upper portions. This spatial variation is associated with changes in the stream environment (Beak 1982f). In addition, densities were greater in the fall than in the spring. These seasonal variations in densities are attributed to factors such as light intensity and duration temperature, substrate, nutrients, and stream flow. Chlorophyll a densities were similar to periphyton densities, i.e., greater in the fall than in the spring. Dry weight organic matter did not show seasonal trends, however, levels were greater in the lower East Boulder River than further upstream (Beak 1982f).

Data collected by Beak Consultants in 1981 and by Weston Consultants in 1989 were used to determine benthic macroinvertebrate taxonomic composition and density in the East Boulder River. Results show both seasonal and spatial variation. The greatest number of taxa and the greatest densities were found in the lower East Boulder River in the fall. The lower portion of the river appears to be more diverse which may account for the greater numbers found there (Beak 1982f). Also, there is an abundance of early larval and nymphal instars of insects during the fall which probably accounts for the greater numbers found at that time of year (Beak 1982f). Most of the taxa collected are indicative of a clean, healthy stream environment and are typically important components of a trout's diet (Weston 1989).

### 3.7.3 Fisheries

The Main Boulder River in the study area is classified as a Class 3 ("red ribbon") stream by MDFWP, meaning an important trout stream of statewide value (Beak 1982f) and is listed by GNF as a Class A stream, meaning it has a fishery of the highest value. The most abundant fish are brown trout and whitefish, with rainbow trout slightly less abundant. Other fish species present include mottled sculpin, mountain sucker, eastern brook trout, and cutthroat trout. Rainbow trout spawn in this portion of the Boulder river (Weston 1989), and brown trout and mountain whitefish may spawn here (Beak 1982f). The Main Boulder River is also used by migratory brown and rainbow trout from the Yellowstone River.

The fishery resource of the East Boulder River is classified by MDFWP as Class 4 (Weston 1989), and is listed by GNF as a Class B stream (FS 1990b). Both classifications mean it is regionally or locally important. Brown trout and rainbow trout are the most abundant species, with brown trout the most abundant in lower portions of the river, and rainbow trout the most abundant upstream from the GNF boundary. Small populations of genetically pure Yellowstone cutthroat trout are present above a natural fish barrier to upstream migration on the East Boulder River near Brownlee Creek. Other species found on the river include whitefish, found on the lower portions of the river; cutthroat trout and cutthroat X rainbow hybrids found above Canyon Creek and downstream to the mouth of Dry Fork, and brook trout found along the lower portion of the East Boulder River in small numbers.

Resident populations of brown trout over 3 inches in length were estimated at 115 to 151 fish/1,000 feet at three stations in 1989, with an average length of 6.7-7.7 inches (Weston 1989). Rainbow trout populations were 16 and 40 fish/1,000 feet in the lower two stations, and 230 fish/1,000 feet near the mouth of Dry Fork on the East Boulder River. The average length of rainbow trout ranged from 6.2 to 7.6 inches. These numbers and sizes are generally comparable to those reported from 1981 and 1982 fish studies (Beak 1982f), when more stations were sampled. The lower East Boulder River appears to be an important spawning area for brown trout (Weston 1989); rainbow trout may also spawn in small localized areas of the river (Weston 1989). Spawning movements between the lower East Boulder and Main Boulder River were reported by Beak (1982f).

Dry Fork, Brownlee Creek, and Canyon Creek are all listed as Class C fisheries (FS 1990b), meaning they have limited local significance, providing lower quality dispersed fishing opportunity. These streams have few fish over 10 inches in length, and harvestable numbers are limited. Naturally reproducing Yellowstone cutthroat trout of unknown origin are present on the upper portion of Canyon Creek and in Camp Lake, while no fish are present at the mouth (FS 1990b). Brown trout are reported to be present in Brownlee Creek; (FS 1990b), however, no fish are present at the mouth (Beak 1982f; FS 1990b). Upper Brownlee Creek is apparently barren of fish. The fish community in lower Dry Fork Creek is comparable to that present nearby in the East Boulder River, with rainbow trout the most abundant, followed by brown trout (Beak 1982f).

Fishing pressure on the East Boulder River is minor relative to fishing pressure on the Main Boulder River (Weston 1989). Most fishing takes place on the lower part of the river downstream from the National Forest boundary. Brown and rainbow trout were the only game species taken from the river in 1989 according to angler interviews conducted by Weston Consultants. The highest fishing pressure in the Boulder drainage is on the Main Boulder River from the Natural Bridge to the mouth. Average annual use was 15,062 angler days from 1982-86 on 82 miles of river, according to MDFWP mail surveys. Fishing pressure on the Boulder River was below normal in 1989. This may be attributed to several factors including the "two-fish limit"

instituted in 1989 by MDFWP to relieve pressure on state fisheries after several years of drought, rainstorms on many weekends during the summer, and an extended period of high, unfishable spring runoff (Poore 1990b).

### 3.7.4 Species of Special Concern

Species of special concern include species listed as endangered or threatened by the federal government, those under review for listing, species listed as sensitive by the Northern Region of the US Forest Service and GNF, and species considered sensitive by the Montana Natural Heritage Program. Only one aquatic species of special concern is present in the study area, Yellowstone cutthroat trout. This species is considered sensitive by the US Forest Service (USFS 1989a); and is listed as S2/G5T3 species by the Montana Natural Heritage Program, indicating that it is endangered in the State of Montana (Montana Natural Heritage Program 1990). Yellowstone cutthroat trout were stocked in Placer Basin on the upper East Boulder River in 1971 (Poore 1990b). The steep gradient of the East Boulder River has prevented other trout species from penetrating this area. In August of 1989, 29 trout from this population were collected from the head of the East Boulder river above Picket Pin Road for genetic purity analysis. Careful electrophoretic examination of fish muscle, eye, and liver tissue showed the fish to be genetically pure Yellowstone cutthroat trout (Weston 1989). Genetically pure Yellowstone cutthroat trout were also found in the East Boulder River about one-half to three-quarters mile upstream of the mouth of Brownlee Creek, during studies in 1990 (Zubik 1990b). This population is separated by a steep barrier falls from a hybrid population in the East Boulder River about one mile below Brownlee Creek.

## 3.8 VEGETATION, WETLANDS, AND TIMBER RESOURCES

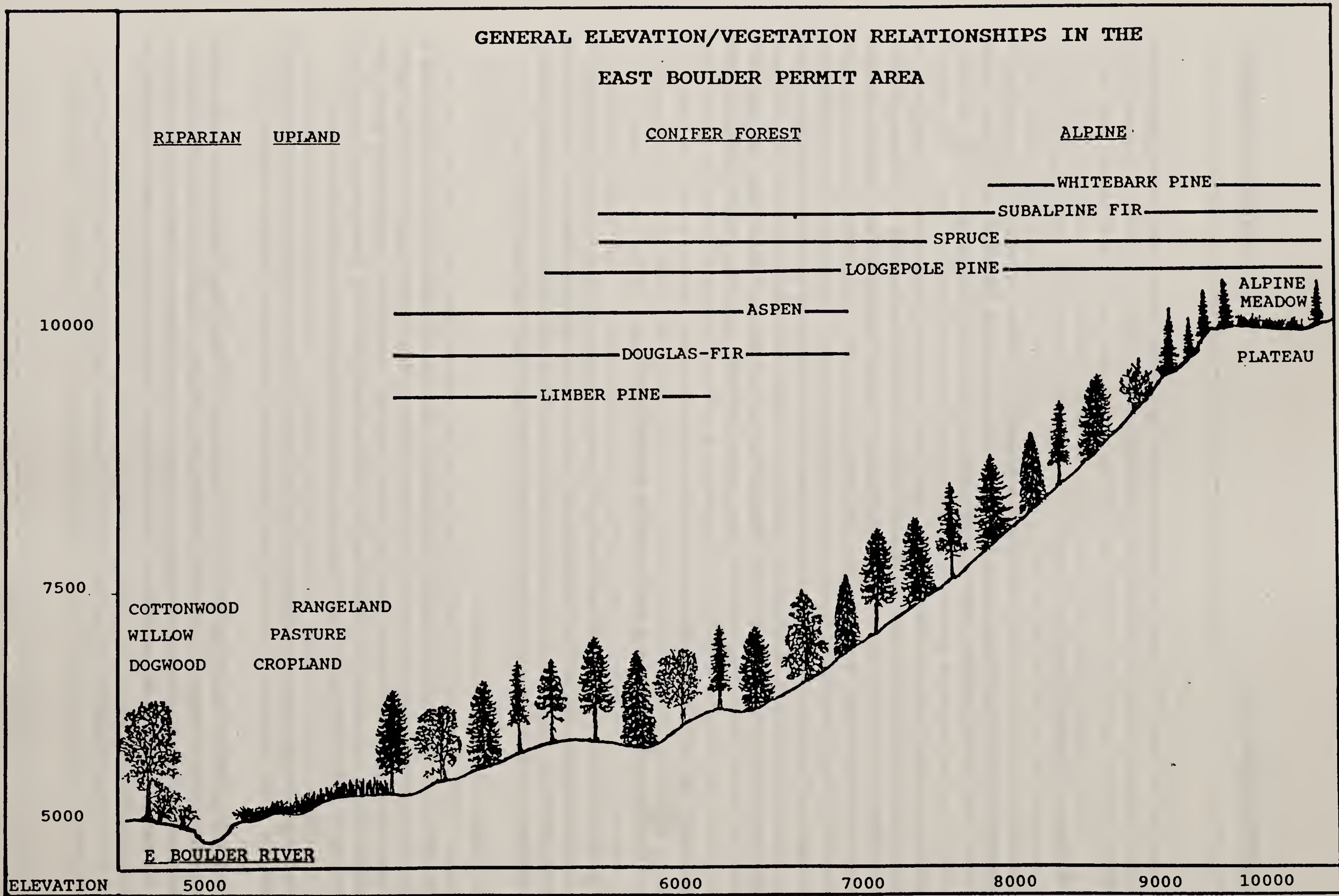
Vegetation of the East Boulder Mine Project study area was mapped according to dominant habitat types at a scale of 1:24,000 (Beak 1982c). An additional study concentrated on plant species of special concern and on noxious weeds (Western Technology & Engineering 1989). Other vegetation information has been assembled by the U.S. Forest Service and Montana Natural Heritage Program personnel.

### 3.8.1 General Vegetation Conditions

Vegetation across the study area ranges from cottonwood riparian communities at the lowest elevation to alpine plant associations at the top of the East Boulder Plateau. Intermediate vegetation includes cropland, pasture, range, and conifer forest (see Fig. 3.8-1). Riparian communities were mapped along major perennial water courses at low elevations and are dominated by black cottonwood, narrow leafed cottonwood, water birch, aspen, and willow. Aspen occur in small patches mainly on moist sites.

Cropland occurs on low terraces adjacent to the East Boulder River. Cropland is mainly planted in small grains and alfalfa or grass hay. Grass or grass/alfalfa pasture is mixed with cropland units.

Rangeland is found above cropland and below forest sites at low elevations. Rangeland is most common on dry aspects and is mapped as rangeland on private property and as "shrub-steppe" on federal property. Dominant grasses include Idaho fescue, bluebunch wheatgrass, prairie junegrass, needlegrasses, and bromes. Shrubs include big sagebrush and juniper. Common forbs are buckwheat, western gromwell, sego lily, and western yarrow.



GENERAL ELEVATION/VEGETATION RELATIONSHIPS IN THE
EAST BOULDER PERMIT AREA
RIPARIAN
UPLAND
CONIFER FOREST
ALPINE
WHITEBARK PINE
SUBALPINE FIR
SPRUCE
LODGEPOLE PINE
ASPEN
DOUGLAS-FIR
LIMBER PINE
ALPINE MEADOW
PLATEAU
10000
7500
5000
COTTONWOOD
WILLOW
DOGWOOD
RANGELAND
PASTURE
CROPLAND
E. BOULDER RIVER
ELEVATION
5000
6000
7000
8000
9000
10000


FIGURE 3.8-1

Forest vegetation is dominated by conifer trees including limber pine, lodgepole pine, Douglas-fir, subalpine fir, whitebark pine, and spruce. The dominant forest type in the East Boulder permit area has relatively pure stands of dense, seral lodgepole pine.

Dry forest sites on south and west exposures have more open stands of Douglas-fir and lodgepole pine with smaller amounts of limber pine and juniper. The driest forest sites have limber pine with an understory of Idaho fescue, ninebark, juniper, and snowberry. Other dry forest understory species include arrowleaf balsamroot, wild onion, pussytoes, Idaho fescue, and buckwheat.

Mid-elevation forests are dominated by three Douglas-fir habitat types with overstories of Douglas-fir and lodgepole pine. These forest types cover approximately 14 percent of the study area. Understory species include snowberry, ninebark, pinegrass, heartleaf arnica, elk sedge, and creeping Oregon grape.

More moist aspects and higher elevations are dominated by subalpine fir, lodgepole pine, whitebark pine and spruce. Spruce habitat types cover about 6 percent of the study area while subalpine fir habitat types accounted for just over 30 percent of the area.

The highest elevations have alpine forb and grass communities intermixed with wind-stunted conifer forests of whitebark pine, subalpine fir, and spruce.

Vegetation was described in 28 units including 5 climax conifer series. These 5 series include limber pine, Douglas-fir, spruce, subalpine fir and scree. Of the 28 different units, 14 of them are named for individual habitat types as described in Forest Habitat Types Of Montana, (Pfister et al. 1977). Six units are complexes of habitat types and eight additional units describe broad plant/land use associations. These broad units are agricultural, shrub-steppe, aspen, bottomland hardwood, cropland, pasture, rangeland, and meadow. Table 3.8-1 lists acreages and extent of all units.

### 3.8.2 Habitat Types and Plant Communities

The study area for the vegetation portion of this document was delineated to include all anticipated phases of project development. Brief descriptions of vegetation units (Beak 1982c) are presented below. Map units in parenthesis refer to the Beak study.

**SCREE/ROCK (MAP UNIT 010):** This unit describes the steep, generally unstable slopes covered with loose rock and coarse fragments and an associated vegetative component. The overstory is composed of Douglas-fir, limber pine, and subalpine fir. This unit composes 4.55 percent of the study area.

**WATER (MAP UNIT 011):** This unit has a total of 72 acres which is 0.44 percent of the study area.

**RESIDENTIAL (MAP UNIT 012):** Homesteads within the study area were mapped in this unit. It is responsible for 0.17 percent of the area.

**CROPLAND (MAP UNIT 013):** This map unit is found in the lower elevation and in the northern vicinity of the study area. Typical crops grown in the area are small grains and alfalfa. Cropland was mapped on 1,104 acres and accounts for 6.71 percent of the total area.

TABLE 3.8-1
HABITAT TYPES THAT OCCUR IN THE EAST BOULDER RIVER STUDY AREA

| Habitat Type | Area | Percent of Total |
|---|---|---|
| Scree/Rock (010)* | 748 | 4.55 |
| Water (011) | 72 | 0.44 |
| Residential (012) | 28 | 0.17 |
| Cropland (013) | 1104 | 6.71 |
| Pasture (014) | 2089 | 12.70 |
| Meadow (015) | 525 | 3.19 |
| Rangeland (016) | 1420 | 8.63 |
| Shrub-steppe (017) | 712 | 4.33 |
| Bottomland hardwood (018) | 737 | 4.48 |
| Aspen (019) | 137 | 0.83 |
| Limber pine/Idaho fescue (050) | 334 | 2.03 |
| Douglas-fir/ninebark (ninebark phase) (261) | 730 | 4.44 |
| Douglas-fir/ninebark (pinegrass phase) (262) | 313 | 1.90 |
| Douglas-fir/ninebark (261/262) | 100 | 0.61 |
| Douglas-fir/common juniper (360) | 395 | 2.40 |
| Douglas-fir/ninebark (ninebark phase) and Douglas-fir/common juniper (262/360) | 758 | 4.61 |
| Douglas-fir/snowberry and Douglas-fir/common juniper (313/360) | 45 | 0.27 |
| Spruce/ninebark (430) | 605 | 3.68 |
| Spruce/sweetscented bedstraw (440) | 206 | 1.25 |
| Spruce/starry Solomon's seal (480) | 20 | 0.12 |
| Spruce/ninebark and Spruce/starry Solomon's seal (430/480) | 235 | 1.43 |
| Subalpine fir/blue huckleberry (720) | 369 | 2.24 |
| Subalpine fir/grouse whortleberry (pinegrass phase) (731) | 610 | 3.71 |
| Subalpine fir/grouse whortleberry (grouse whortleberry phase) (732) | 263 | 1.60 |
| Subalpine fir/pinegrass (750) | 614 | 3.73 |
| Subalpine fir/grouse whortleberry (pinegrass phase) and subalpine fir/pinegrass (731/750) | 485 | 2.95 |
| Subalpine fir/virgin's bower (770) | 653 | 3.97 |
| Subalpine fir-whitebark pine grouse whortleberry (820) | 2143 | 13.03 |
| Total Study Area | 16450 | 100.00 |

Source: Beak 1982c
*Numbers in parentheses refer to map units in 1982 Beak study (Beak 1982c)

**PASTURE (MAP UNIT 014):** Pasture is a site where the vegetation is used primarily by grazing animals. This unit is found in the northern portion of the study area in the lower elevations and was mapped on 2,089 acres comprising 12.7 percent of the study area. Pasture was the second largest mapped acreage in the area.

**MEADOW (MAP UNIT 015):** Timothy is the dominant species in the acreage within GNF property mapped as meadow. This mapping unit is composed of 525 acres and is 3.19 percent of the total study area.

**RANGELAND (MAP UNIT 016):** The dominant plants in rangeland are grasses. This unit was mapped only on the private ownership portion of the study area. Other rangeland on the GNF portion of the study area is mapped as shrub-steppe and has condition class reference on the Dry Fork allotment. The condition is mostly good and excellent and the trend is generally up. There are 1,420 acres of range which is 8.63 percent of the total area.

**SHRUB-STEPPE (MAP UNIT 017):** The major species within this unit are big sagebrush, shrubby cinquefoil, and junipers. Many grass species are found in this unit. The predominant ones are bluebunch wheatgrass, Idaho fescue, needlegrasses, bromes, and prairie Junegrass. Forbs are common and variable, western gromwell and buckwheat being the most frequent. There are 712 acres of shrub-steppe which account for approximately 4.33 percent of the area.

**BOTTOMLAND HARDWOODS (MAP UNIT 018):** This mapping unit is made up of different riparian communities lumped together into this broad category. Many of the species recorded in the study area are classified as having wetland status, from obligate wetland to facultative upland (See Table 3.8-2 for definitions of wetland classifications). Bottomland hardwoods account for 737 acres which is 4.48 percent of the area.

**ASPEN (MAP UNIT 019):** This vegetation community was identified on moist soils within the study area. This unit encompasses 137 acres and is 0.83 percent of the total area.

**LIMBER PINE/IDAHO FESCUE (MAP UNIT 050):** This vegetation type was found on the driest forested site within the study area. The overstory is dominated by limber pine with lesser amounts of Douglas-fir dispersed in the unit. The understory consisted of ninebark, arrowleaf balsamroot, pussytoes, buckwheat and wild onion. This plant community has an open appearance with bare soil and rock outcrop not uncommon. There are 334 acres of this type within the area and is 2.03 percent of the study area.

**DOUGLAS-FIR/NINEBARK, NINEBARK PHASE (MAP UNIT 261):** The Douglas-fir habitat type dominated the forest within the elevation band from approximately 5,400 feet to 6,900 feet. Douglas-fir was the dominant tree in the overstory and lesser amounts of lodgepole pine was present. The understory consisted of a thick shrub component of ninebark, white spirea, and snowberry. Other plants in the understory are pinegrass, heartleaf arnica, creeping Oregon grape, strawberry, and fairybells. This phase differs from the pinegrass phase by which plant dominates the understory. If pinegrass dominates, then the pinegrass phase is mapped; if ninebark dominates, then the ninebark phase is appropriate. There were 730 acres of this habitat type and phase identified in the study area, and it is 4.44 percent of the area.

TABLE 3.8-2

WETLANDS VEGETATION

| Scientific Name | Common Name | Wetland Designation[a] |
|---|---|---|
| **Trees** | | |
| Abies lasiocarpa | Subalpine fir | FACU[b] |
| Picea engelmanni | Engelmann spruce | FAC[c] |
| Pinus contorta | Lodgepole pine | FAC |
| Populus tremuloides | Aspen | FAC+[d] |
| Populus trichocarpa | Black cottonwood | FACW[e] |
| Pseudotsuga menziesii | Douglas-fir | FACU |
| **Shrubs** | | |
| Alnus incana | Thinleaf alder | FACW |
| Alnus sinuata | Sitka alder | FACW |
| Berberis repens | Oregon grape | |
| Betula occidentalis | Water birch | FACW |
| Cornus stolonifera | Red-osier dogwood | FACW |
| Potentilla fruticosa | Shrubby cinquefoil | FAC |
| Prunus virginiana | Common chokecherry | FAC |
| Ribes lacustre | Prickly gooseberry | FAC+ |
| Rosa spp. | Rose | |
| Salix bothii | Booths willow | OBL[f] |
| Salix drumondiana | Drummonds willow | FACW |
| Salix exigua | Sandbar willow | OBL |
| Salix scouleriana | Scoulers willow | |
| Shepherdia canadensis | Canada buffaloberry | |
| Spirea betulifolia | White spirea | |
| Symphoricarpos albus | Snowberry | FACU |
| Vaccinium scoparium | Grouse whortleberry | |
| **Grasses, Sedges, and Rushes** | | |
| Agropyron caninum | Cutting wheatgrass | FAC-[g] |
| Agropyron subsecundum | Bearded wheatgrass | |
| Agropyron trachycaulum | Slender wheatgrass | FAC |
| Bromus carinatus | California brome | |
| Bromus ciliatus | Fringed brome | FAC+ |
| Calamagrostis canadensis | Bluejoint reedgrass | FACW+ |
| Calamagrostis neglecta | Narrowspike small reedgrass | FACW |
| Carex spp. | Sedge | |
| Carex concinnoides | | |
| Carex geyeri | Elk sedge | |

TABLE 3.8-2
(Continued)

| Scientific Name | Common Name | Wetland Designation[a] |
|---|---|---|
| Carex microptera | Small-wing sedge | FAC |
| Carex rostrata | Beaked sedge | OBL |
| Deschampsia cespitosa | Tufted hairgrass | FACW |
| Elymus glaucus | Blue wildrye | FACW |
| Hordeum brachyantherum | Meadow barley | FACW |
| Juncus ensifolius | Three-awn rush | FACW+ |
| Phleum pratense | Timothy | FACU |
| Poa palustris | Fowl bluegrass | FAC |
| Poa pratensis | Kentucky bluegrass | FACU+ |
| **Forbs** | | |
| Archillea millefolium | Common yarrow | FACU |
| Aconitum columbianum | Columbia monkshood | FACW |
| Actaea rubra | Baneberry | |
| Anaphalis margaritacea | Pearly everlasting | |
| Anemone multifida | Anemone | |
| Arctium minus | Burdock | |
| Aster spp. | Aster | |
| Aster conspicuus | Showy aster | |
| Aster occidentalis | Western mountain | FAC |
| Cirsium arvense | Canada thistle | |
| Delphinium occidentale | Duncecap larkspur | FACU- |
| Epilobium angustifolium | Fireweed | |
| Epilobium watsonii | Watsons fireweed | |
| Equisetum arvense | Field horsetail | FAC |
| Fragaria virginiana | Strawberry | |
| Geranium richardsonii | Cranes-bill geranium | FACW+ |
| Geum macrophyllum | Large leaf arvense | FACW+ |
| Habenaria dilatata | Bog orchid | |
| Hedysarum sulphurescens | Sweetvetch | |
| Heracleum lanatum | Cow parsnip | FAC |
| Ipomopsis (Gilia) aggregata | Impomopsis | |
| Ligusticum filicinum | Lovage | |
| Melilotus officinalis | Yellow sweetclover | FACU |
| Mertensia ciliata | Streamside bluebells | FACW+ |
| Mimulus guttatus | Yellow monkey flower | OBL |
| Solidago missouriensis | Missouri goldenrod | |
| Monarda fistulosa | Horsemint | FACU |
| Osmorhiza chilensis | Mountain sweet-cicely | |

TABLE 3.8-2
(Concluded)

| Scientific Name | Common Name | Wetland Designation[a] |
|---|---|---|
| Parnassia firmbiata | Grass of parnassus | OBL |
| Pedicularis bracteosa | Bracted lousewort | |
| Pedicularis groenlandica | Elephanthead | OBL |
| Potentilla spp. | Cinquefoil | |
| Rudbeckia occidentalis | Western coneflower | |
| Rumex crispus | Curly dock | |
| Saxifraga odontoloma (arguta) | Brook saxifrage | FACW+ |
| Senicio triangularis | Arrowleaf groundsel | FACW+ |
| Senecio spp. | Groundsel | |
| Taraxacum officinale | Common dandelion | FACU |
| Thalictrum occidentale | Western meadowrue | FACU |
| Tragopogon dubius | Salsify | |
| Trifolium spp. | Clover | |
| Urtica dioica | Stinging nettle | |
| Veratrum californicum | False helebore (skunkcabbage) | FACW+ |
| Veronica americana | American speedwell | OBL |
| Vicia americana | American blue vetch | |
| Zigadenus elegans | Mountain death camas | |

[a] Reed 1988 - source of wetland designations.

[b] FACU - Faculative upland plants - plants that usually occur in nonwetlands, but are occasionally found in wetlands (estimated probability 1-33%).
[c] FAC - Faculative plants - plants that are equally likely to occur in wetlands or nonwetlands (estimated probability 34-66%).
[d] (+) - The positive sign indicates a frequency toward the higher end of the category.
[e] FACW - Faculative wetlands plants - plants that usually occur in wetlands (estimated probability 67-99%), but occasionally found in nonwetlands.
[f] OBL - Obligate wetland plants - plants that occur almost always (estimated probability >99%) in wetlands under natural conditions.
[g] (-) - The negative sign indicates a frequency toward the lower end of the category.

**DOUGLAS-FIR/NINEBARK, PINEGRASS PHASE (MAP UNIT 262):** This community is very similar to unit 261 except that the understory is dominated by pinegrass. This vegetation phase represents a slightly warmer site than the ninebark phase. This is 1.90 percent`of the total 313 acres mapped.

**DOUGLAS-FIR/NINEBARK (MAP UNIT 261/262):** This is a complex of mapping units within the Douglas-fir/ninebark habitat type. This unit is a combination of the above Douglas-fir/ninebark but has no differentiation to phase. This was mapped on 100 acres and is 0.61 percent of the total.

**DOUGLAS-FIR/COMMON JUNIPER (MAP UNIT 360):** This mapping unit occurred infrequently within the study area. This is a dry Douglas-fir habitat type. The overstory is composed mostly of Douglas-fir with lesser amounts of lodgepole pine and limber pine. The understory is made up of common juniper, kinnikinnick, strawberry, yarrow, and wheatgrasses. There are 390 acres of this habitat type which is 2.40 percent of the study zone.

**DOUGLAS-FIR/NINEBARK, NINEBARK PHASE, AND DOUGLAS-FIR/COMMON JUNIPER (MAP UNIT 262/360):** This mapping unit is a complex of two previously described habitat types. There are 758 acres of this unit comprising 4.61 percent of the study area.

**DOUGLAS-FIR/SNOWBERRY, AND DOUGLAS-FIR/COMMON JUNIPER (MAP UNIT 313/360):** The mapping unit complex consists of the previously described Douglas-fir common juniper in a mosaic with the Douglas-fir/snowberry habitat type. The latter habitat type is limited to the northern end of the GNF and was found only in two small stands between 6000 and 6500 feet. The dominant tree in the overstory is Douglas-fir and the understory is composed primarily of snowberry. There are 3 phases of this habitat type, though this map unit did not delineate to the phase level. There are 45 acres of this habitat type which constitutes 0.27 percent of the area.

**SPRUCE/NINEBARK (MAP UNIT 430):** This was the most common spruce habitat type found in the study area. It is found on north slopes between approximately 5,700 feet to 6,400 feet. Spruce and Douglas-fir are the codominants, although lodgepole pine is present. The major understory plants are russet buffaloberry, snowberry, clematis, mountain maple, heartleaf arnica, creeping Oregon grape, and wintergreen. There are 605 acres of this habitat type and this constitutes 3.68 percent of the total.

**SPRUCE/SWEETSCENTED BEDSTRAW (MAP UNIT 440):** This community was found on cool moist sites in the GNF portion of the study area. Spruce is the dominant tree in the dense overstory though Douglas-fir is present. The major components in the understory are red-ozier dogwood, rose, sweetscented bedstraw, and wintergreen. There are 206 acres of this habitat type, constituting 1.25 percent of the total.

**SPRUCE/STARRY SOLOMON'S SEAL (MAP UNIT 480):** There were only 20 acres of this mapping unit in the study area. This unit is characterized by an overstory of Douglas-fir and lodgepole pine. The spruce and Douglas-fir are reproducing. The understory species are kinnikinnick, milkvetch, creeping Oregon grape, white spirea, and starry Solomon's seal. This unit was 0.12 percent of the study area.

**SPRUCE/NINEBARK AND SPRUCE/STARRY SOLOMON'S SEAL (MAP UNIT 430/480):** This mapping unit is a complex of two previously described individual habitat types. There are 235 acres of this unit and it accounts for 1.43 percent of the area.

**SUBALPINE FIR/BLUE HUCKLEBERRY (MAP UNIT 720):** This mapping unit was found within a 1,000-foot elevational band on cool aspects within the GNF portion of the study area. The dominant tree in the overstory is lodgepole pine with minor amounts of spruce and Douglas-fir. Shrubs in the understory are blue huckleberry, grouse whortleberry, ninebark, snowberry, and twinflower. Pinegrass and heartleaf arnica are well represented in the understory. There are 369 acres of this habitat type which is 2.24 percent of the total.

**SUBALPINE FIR/GROUSE WHORTLEBERRY, PINEGRASS PHASE (MAP UNIT 731):** This mapping unit comprises 610 acres of the study area and is 3.71 percent of the total. The dominant tree in the overstory is lodgepole pine with lesser amounts of Douglas-fir and spruce. The understory is composed of grouse whortleberry, snowberry, white spirea, pinegrass, heartleaf arnica, and elk sedge. This phase of the habitat type is characterized by the amount of pinegrass present.

**SUBALPINE FIR/GROUSE WHORTLEBERRY, GROUSE WHORTLEBERRY PHASE (MAP UNIT 732):** This habitat type is the same as described in mapping unit 731, the only difference being at the phase level. The grouse whortleberry phase does not have a significant amount of pinegrass. There are 263 acres of this phase, for 1.6 percent of the study area.

**SUBALPINE FIR/ PINEGRASS (MAP UNIT 750):** This is the warmest habitat type within the subalpine fir series. Lodgepole pine is the dominant tree in the overstory; spruce and Douglas-fir are present. The major understory plants consists of white spirea milkvetch and heartleaf arnica. There are 614 acres of this habitat type and accounts for 3.73 percent of the study area.

**SUBALPINE FIR/GROUSE WHORTLEBERRY, PINEGRASS PHASE, AND SUBALPINE FIR/PINEGRASS (MAP UNIT 731/750):** This mapping unit is a complex of two previously described mapping units. There are 485 acres of this unit, for 2.95 percent of the study area.

**SUBALPINE FIR/VIRGIN'S BOWER (MAP UNIT 770):** This habitat type is reported to be in the study area but was not verified. It appears on the vegetation map with dashed lines. There are 653 acres of this unit, for 3.97 percent of the area.

**SUBALPINE FIR-WHITEBARK PINE/GROUSE WHORTLEBERRY (MAP UNIT 820):** This is the most extensive mapping unit within the study area and is common in the high elevation forests east of the continental divide. The major trees in the overstory are subalpine fir, whitebark pine, and spruce. The understory plants found in this habitat type are mountain-heather, Laborador tea, and mountain arnica. There are 2,143 acres of this unit which accounts for approximately 13.03 percent of the area.

### 3.8.3 Sensitive Species

Sensitive plant species were investigated in several reports and field investigations (SPGMR 1989a). One species of potential concern was identified at the East Boulder Mine Project site. This small, white-flowered forb is a particular form of western springbeauty (Claytonia lanceolata var. flava) and is classified as a sensitive plant with a C2 designation by the Northern Region U.S. Forest Service (Figure 3.8-2). It has also been placed in Category 2 by the U.S. Fish & Wildlife Service as a candidate for possible listing under the federal Endangered Species Act. C2 taxa are those "... for which there is some evidence of vulnerability, but for which there are not enough data to support listing proposals at this time" (U.S. Department of Interior 1990).

CLAYTONIA LANCEOLATA VAR. FLAVA

FIGURE 3.8-2

Initial field investigations at the East Boulder permit area, conducted during June 1990, found Claytonia occurs in great number throughout the area. Claytonia plants were identified within the general study area and within the specific sites to be disturbed by mine development. Personnel from the GNF, the Montana Natural Heritage Program, and Land & Water Consulting Inc. counted more than 250 individual springbeauty plants in one 4,000-square-foot area adjacent to the road at the "keyhole" area on June 16, 1990. Springbeauty was found at virtually every stop on a reconnaissance of the East Boulder Mine site in suitable habitat on the same date.

These findings revealed the need for an additional survey on the distribution of Claytonia in the East Boulder River drainage and other areas of the Gallatin National Forest. Such a survey was conducted in June 1991, by the Montana Natural Heritage Program (Schassberger Roe 1991). The East, Main, and West Boulder River drainages and selected areas of the Gallatin National Forest were surveyed for the presence of Claytonia lanceolata var. flava. Numerous large populations and subpopulations were located in the East Boulder River drainage on both Forest Service and private lands. Four subpopulations were located in the East Boulder permit area, two containing approximately 1,000 plants each, and two smaller subpopulations containing 5 and 50 plants respectively. Other large populations were found both above and below the East Boulder permit area, several of which contain tens of thousands of plants. Several small populations were found along the Main Boulder River and one small and one large population were found along the West Boulder River. Claytonia lanceolata var. flava was also found in other areas of the Gallatin National Forest and it is known to occur in other counties in Montana.

Based on population information acquired from this survey and other sources, the Montana Natural Heritage Program state rank for Claytonia lanceolata var. flava will be changed from S1 (critically imperiled in Montana because of extreme rarity, 5 or fewer occurrences), to S3 (rare in Montana, 21 to 100 occurrences).

The taxonomy of Claytonia lanceolata var. flava is currently under review, specifically with regard to flower color and leaf morphology. This variety has been recognized as one of several in the species, primarily based on yellow flower color. However, morphological and genetic studies completed to date suggest that the variety is distinct at the full species level, and can itself be either yellow- or white-flowered. It is unlikely that the taxonomic evaluation will be finalized by botanists during this EIS process; however, at this time the Claytonia at the project site is tentatively identified as the white-flowered form of Claytonia lanceolata var. flava. Its distinguishing features are white flower color with long, narrow leaves (see description and diagram).

### 3.8.4 Wetlands

Wetlands have become a special concern in recent years as their values become better understood. Wetlands play a major role in water quantity and quality control, serving as buffers for floods and as natural filters for sediments and pollutants. Wetlands provide extremely abundant and diverse habitats for plants and animals. Wetlands are a critical link in natural ecosystems. Recent interest in wetlands has focused on minimizing or mitigating human impacts on these areas.

Wetlands within the study area were mapped according to the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Federal Interagency Committee for Wetland Designation 1989). To be defined as wetlands a location must meet criteria in three areas, including: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology.

Wetlands in the study area occur in two distinct settings, either as discrete units entirely made up of wetlands, or as part of larger riparian areas that have small wetland and non-wetland components. Wetlands range from a few square feet to tens of acres in size. The majority of wetlands in the East Boulder Mine Project area are very small and cannot be delineated at common mapping scales. Mapping units were used to delineate the areas within which most wetlands and wetland vegetation occur (Figure 3.8-3). Wetlands were not inventoried on the East Boulder Plateau area.

Wetlands were mapped at a scale of 1:24,000 in three distinct mapping units. The first mapping unit is composed entirely of wetlands and is dominated by willows, sedges, or cattails (W1). This unit occurs mainly in depressions with perched water tables, and/or where springs occur. The estimated area of W1 wetlands is 110 acres.

The other two wetland mapping units are composed of a mixture of wetlands and non-wetland riparian areas along the East Boulder River. North of the GNF boundary (Section 20, T3S, R13E) these areas are mostly dominated by broadleaf tree species and shrubs (W2). The estimated area of W2 wetlands is 79 acres. South of the GNF boundary, these areas are mostly dominated by conifer tree species and shrubs (W3). The estimated area of W3 wetlands is 135 acres.

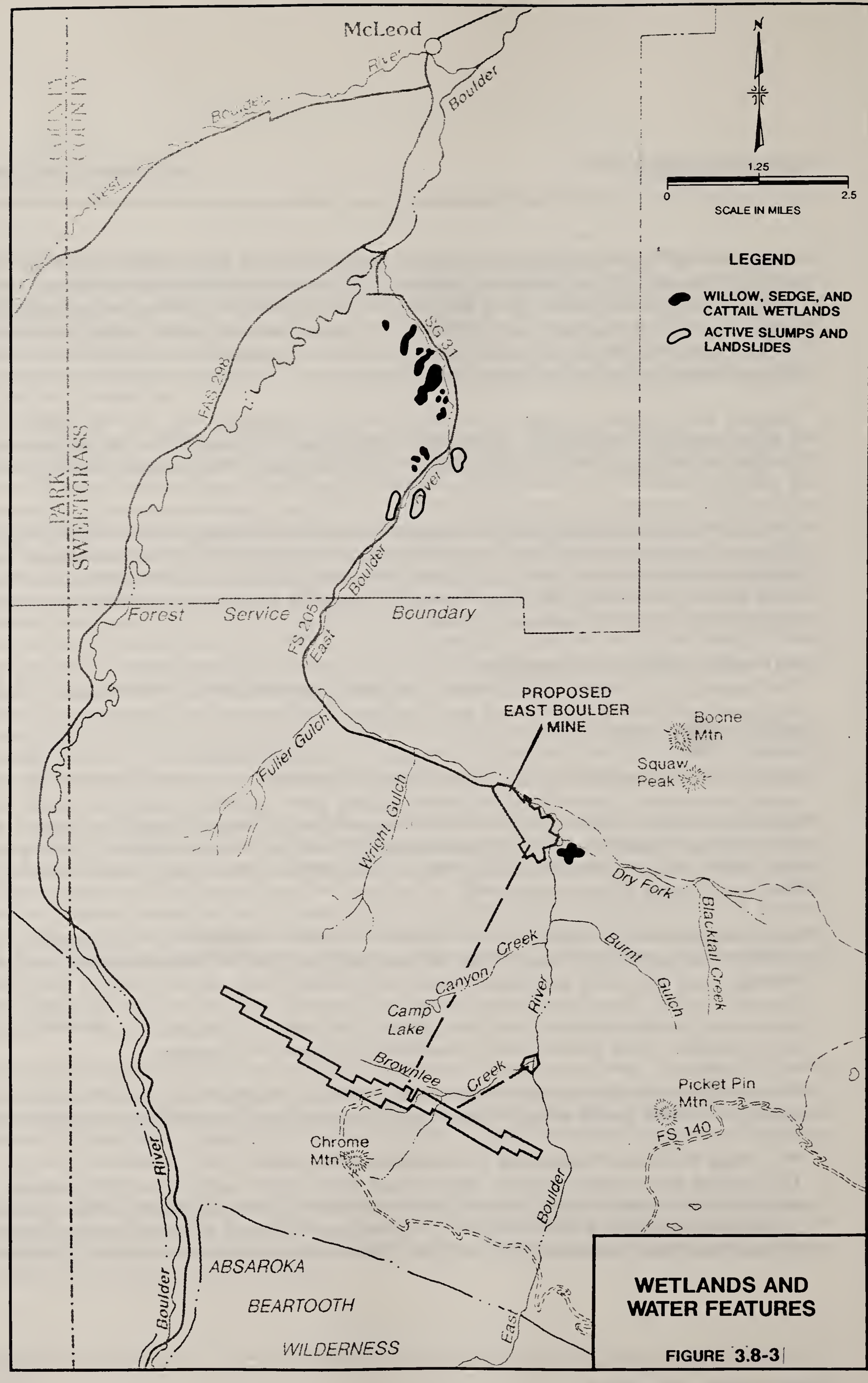
**W1 - Willow, Sedge and Cattail Wetlands**
This mapping unit is located almost exclusively on private lands north of the GNF boundary. It occupies depressions and relatively flat areas with high water tables. This mapping unit is composed entirely of sites meeting wetland criteria.

W1 is dominated by wetland vegetation (obligate wetland and facultative wetland species) especially willows, sedges, and cattails. Trees are rare but include quaking aspen and black cottonwood. Shrubs include Booth's willow, Bebb's willow, and water birch. Grasses include Kentucky bluegrass and timothy. Other common plants include Nebraska sedge, beaked sedge, field mint, and Watson's fireweed. Common riparian types in this mapping unit are Salix geyerii/Carex rostrata, Populus tremuloides/Cornus stolonifera, Salix lutea/carex rostrata, (Hanson et al. 1990).

Soils are highly variable in this mapping unit but many have dark, low-chroma colors and high organic matter contents. They include loams, sandy loams, silt loams, and clay loams with low to moderate rock contents. Although some layers have high organic matter contents they usually do not qualify as histic horizons (organic horizons). These soils sometimes are gleyed or mottled, but not in all cases. The surface of these soils is usually inundated by water throughout the year. The surface soil may dry up in years with unusually low precipitation. Most of these soils are classified as Cryaquents or Cryaquepts.

These sites are depressions and other low areas where shallow groundwater is perched on impermeable soil layers at or near the ground surface. Water often surfaces during portions of the year as ponds or springs.

**W2 - Mixed Hardwood Wetlands and Non-Wetland Riparian Areas**
This mapping unit is located primarily along the East Boulder River north of the GNF boundary. Sites meeting wetland criteria occur as very small areas within this mapping unit, mainly in swales, depressions, old meander channels and other low areas. Wetlands comprise about 20 percent of this unit with the remaining area being non-wetland riparian types. Hardwood trees dominate the overstory in this unit.




**WETLANDS AND WATER FEATURES**

FIGURE 3.8-3

The overstory of this unit is dominated by black cottonwood and aspen with scattered Engelmann spruce. Douglas-fir, lodgepole pine, and subalpine fir are uncommon but may also occur. The understory is often dominated by shrubs including Booth's willow, Bebb's willow, red-osier dogwood, hawthorn, water birch, gooseberry, and rose. Forbs include showy aster, western meadow-rue, field horsetails, and stinging nettle. Kentucky bluegrass and orchardgrass are also common. Typical riparian types in this mapping unit include Populus trichocarpa/cornus stolonifera, Populus tremuloides/poa pratensis, and Populus tremuloides/cornus stolonifera (Hanson et al. 1990).

Soils in this mapping unit are variable but most have sandy loam or sand textures with abundant gravel and cobble size rocks. Occasional layers of rock-free sand or sandy loam occur. These are alluvial soils (deposited by running water). The wetland soils in the mapping unit often do not have distinctive hydric features such as mottles and gley. Water is usually present within 1-2 feet of the surface throughout the year, and the surface is saturated for a significant period of time, on the order of many months. These wetland soils are classified as Fluvaquents, Cryaquents, and Cryofluvents.

These wetlands are in floodplain areas along current and former stream channels and in depressions. They are flooded annually and have high groundwater levels at or near the surface for long periods.

**W3 - Mixed Conifer Wetlands and Non-Wetland Riparian Areas**
This mapping unit occurs along the East Boulder River south of the GNF boundary. Sites meeting wetland criteria occur as very small areas within this mapping unit, mainly in swales, depressions, old meander channels, and other low areas along the stream. Most of this segment of the East Boulder River is deeply incised and has only a narrow ribbon of riparian vegetation along the immediate banks. Wetlands comprise about 15 percent of this unit with the remaining area being non-wetland riparian types. Conifer trees dominate the overstory in this unit although some hardwoods also occur.

This unit also extends up adjacent small stream courses as a narrow ribbon of riparian vegetation along the immediate banks.

The overstory of this unit is dominated by Engelmann spruce. Black cottonwood, aspen, Douglas-fir, lodgepole pine, and subalpine fir also occur. The understory is often dominated by shrubs including Booth's willow, Bebb's willow, red-osier dogwood, hawthorn, water birch, gooseberry, and rose. Forbs include field horse tails, arrowleaf groundsel, thimbleberry, cow parsnip, showy aster, bedstraw, Canada thistle, and stinging nettle. Kentucky bluegrass, orchardgrass, timothy, bluejoint reedgrass, and beaked sedge are also common. Common riparian types in this mapping unit are Picea engelmannii/equisetum arvense and Picea engelmannii/Cornus stolonifera (Hanson et al. 1990).

Soils in this mapping unit are variable but most have sandy loam or sand textures with abundant gravel and cobble-size rocks. Occasional layers of rock-free sand or sandy loam occur. These are alluvial soils. The wetland soils in this mapping unit often do not have distinctive hydric features such as mottles and gley. Water is usually present within 1-2 feet of the surface throughout the year and the surface is saturated for many months. These wetland soils are classified as Fluvaquents, Cryaquents, and Cryofluvents.

### 3.8.5 Timber

Commercial timber resources were identified using information from the GNF Plan and Supplemental Biological Studies performed by SPGMR (1990). Additional information was obtained from conversations with GNF personnel.

The East Boulder Mine Project area contains approximately 260 acres of commercial timber. Approximately 70 acres have been harvested for exploration activities, for posts and poles, and for construction of the weather station, roads, etc. Management Areas (MA) were established in the Gallatin Forest Plan (FS 1987a) and assigned management goals. The largest or most prevalent Management Areas within the East Boulder study area include MAs 3, 6, and 8. MAs 3 and 6 are found in the plateau portion of the study area and classified as unsuitable for timber production, while MA 8 includes the mine adit and facilities area. The management goal for MA 3 is essentially to maintain the status quo. The management goal for MA 6 is to improve recreation opportunities and to provide and create additional public access.

MA 8 is classified as suitable for timber production. The goals for this MA emphasize commercial timber and a sustained timber production by development of an equal distribution of age classes. Timber management in this unit will favor Douglas-fir and lodgepole pine. Other species will be maintained for ecological diversity. Secondary to timber in this area is the allowance for other resource uses that mesh with the timber oriented goals. The last goal identified is to maintain the integrity of stream channels and meet applicable water quality standards.

Stand exams in 1981 identified approximately 35 million board feet of commercial timber in timber compartments 112, 113, 114, and 115. Those units are located primarily along the south side of the East Boulder River and occur in MA 8 (see Figure 4.6-1 for timber compartment locations).

There have been approximately 300 acres of timber harvested in the study area during the last decade. Timber was clearcut harvested at the proposed East Boulder Mine Project site during 1988-89 in anticipation of mine exploration construction activities. No future timber harvest or other timber management activities are planned for the immediate East Boulder Mine Project area, although some cutting will occur as part of wildlife habitat improvements. Timber sales outside the East Boulder Mine Project area, but within the Stillwater Complex such as the Wright-Gulch Timber Sale, may contribute to overall cumulative impacts on wildlife or other environmental considerations and are discussed in Section 4.8.

### 3.8.6 Noxious Weeds

Noxious weeds are an important local concern due to their impacts on agricultural production and native plant communities. Sweet Grass County and the GNF have active weed control programs. While success is apparent in control of some local weeds, other species have shown resistance to all past control strategies.

The Montana Noxious Weed Control Act identifies nine Category One and five Category Two noxious weed species. The only Category One weed found in the East Boulder Mine Project study area is Canada thistle. Leafy spurge (another Category One weed) is found in dense stands northwest of the study area along the lower Main Boulder River. Leafy spurge is extremely difficult or impossible to control and is the worst potential weed threat for future area developments.

Other weed species of local concern are hound's tongue, spotted knapweed, burdock, and musk thistle. All weeds except leafy spurge can be controlled through prompt revegetation and maintenance herbicide applications.

### 3.9 AIR QUALITY

The air quality of south-central Montana is generally good. In the region containing the Main Boulder River air-shed and the proposed project, the State of Montana monitored for total suspended particulates (TSP), particulate matter of 10 microns or less (PM-10), and sulfur dioxide. There were no violations of the federal ambient air quality standards in the area for $SO_2$, TSP, and PM-10 in 1987. The other criteria pollutants, carbon monoxide (CO), nitrogen dioxide ($NO_2$), ozone ($O_3$), and lead (Pb), were not monitored in this area because there are no major sources of these pollutants in the area. TSP and PM-10 data have also been collected within the project area. Table 3.9-1 presents the TSP and PM-10 data collected within the project area and in the Billings area. These concentrations can be compared to the state and federal ambient air quality standards presented in Table 3.9-2. The maximum 24-hour TSP concentration within the project area was 87 $\mu g/m^3$, measured in 1982. The maximum annual geometric mean for the project area was 20 $\mu g/m^3$ in 1982. The maximum 24-hour PM-10 concentration within the project area was 35 $\mu g/m^3$, measured in 1988. The annual geometric mean was 9 $\mu g/m^3$. These concentrations are well below the corresponding state and federal TSP and PM-10 standards. TSP and PM-10 concentrations measured in the Billings area are also shown in Table 3.9-1. Typically, particulate concentrations are higher in metropolitan areas than concentrations measured in rural areas such as the project location. Therefore, the particulate concentrations collected at Billings can be considered as worst case conditions at the project location.

#### 3.9.1 Climatology and Meteorology

The climate of south-central Montana can be classified as a continental-highland climate. The mountainous terrain in this area causes wide variations in climate within a relatively small area. Elevation has a strong influence on local climate, with low valleys often being semi-arid and high elevations approaching subarctic conditions. Generally average temperatures decrease and precipitation increases with increasing elevation. Due to the elevations, summers in the project area are usually cool, with temperatures in excess of 100°F rarely occurring. Winters are characterized by alternating cold waves and warming Chinook winds.

Monthly mean minimum, mean maximum, and average temperatures measured at the project area during 1981 - 1982 are presented in Table 3.9-3. The average annual temperature recorded at the site was 38.4°F. Mean minimum temperatures range from 16.8°F in January to 44.3°F in August. Mean maximum temperatures range from 34.7 in March to 70.9°F in August. The lowest temperature measured at the site was -22°F recorded in February. The highest temperature measured at the site was 77°F recorded in July, August, and September.

Monthly and annual precipitation totals measured at the project area during the 1981 - 1982 and 1988 - 1989 baseline monitoring programs are presented in Table 3.9-4. The average annual precipitation recorded at the site is approximately 20 to 23 inches. The maximum monthly precipitation recorded at the site was 6.04 inches in January 1982 and 4.39 inches in May 1989. The minimum monthly precipitation recorded at the site was 0.21 inches in November 1981 and 0.77 inches in January 1989.

TABLE 3.9-1

MAXIMUM AND AVERAGE TSP AND PM-10 CONCENTRATIONS ($\mu g/m^3$)
FOR THE PROJECT AREA

| TSP | Maximum 24-hour Average | Annual Average | Annual Geometric Mean |
|---|---|---|---|
| Main Station[a] | | | |
| Sampler #1 | 54 | 13.0 | 9.0 |
| Sampler #2 | 54 | 13.0 | 8.0 |
| Woolsey Station | | | |
| Sampler #3 | 87 | 19.0 | 11.0 |
| Sampler #4 | 28 | 21.0 | 20.0 |
| Billings[b] | | | |
| City Hall #1 | 134 | 61.9 | 57.6 |
| City Hall #2 | 134 | 62.5 | 58.1 |
| Lockwood Park | 172 | 80.8 | 71.0 |
| Grand Avenue School | 95 | 54.7 | 51.9 |
| Scottish Rites | 121 | 75.6 | 73.1 |
| Laurel[b] | | | |
| Laurel Junior High | 121 | 47.9 | 42.3 |
| **PM-10** | | | |
| Main Station[c] | 35 | 9.0 | |
| Billings[b] | | | |
| Grand Avenue School | 53 | 28.7 | |

[a]Source: Beak Consultants, Inc., 1983. Data are from the monitoring year 1982.
[b]Source: Montana Department of Health and Environmental Sciences, 1989. Data are from the monitoring year 1987.
[c]Source: SPGMR 1990. Data are from the monitoring year 1988.

## TABLE 3.9-2

## MONTANA AND NATIONAL AIR QUALITY STANDARDS

| Pollutant | Montana Standard | Federal Primary Standard | Federal Secondary Standard |
|---|---|---|---|
| Total suspended particulates | Replaced by PM-10 standards in 1988 | Replaced by PM-10 standards | 60 $\mu g/m^3$ expected annual average<br>150 $\mu g/m^3$ expected 24-hour average[a] |
| Particulate matter 10 microns and less in diameter (PM-10) | 50 $\mu g/m^3$ expected annual average<br>150 $\mu g/m^3$ expected 24-hour average[a] | 50 $\mu g/m^3$ expected annual average<br>150 $\mu g/m^3$ expected 24-hour average[a] | Same as primary standard |
| Sulfur dioxide | 0.02 ppm annual average<br>0.10 ppm 25-hour average[a]<br>0.50 ppm 1-hour average[b] | 0.03 ppm annual average<br>0.14 ppm 24-hour average[a] | 0.50 ppm 3-24 average[a] |
| Carbon monoxide | 9 ppm 8-hour average[a]<br>23 ppm hourly average[a] | 9 ppm 8-hour average[a]<br>35 ppm 1-hour average | 9 ppm 8-hour average[a] |
| Nitrogen dioxide | 0.05 ppm annual average<br>0.30 ppm hourly average[a] | 0.05 ppm annual average | 0.05 ppm annual |
| Photochemical oxidants (ozone) | 0.10 hourly average[a] | 0.12 ppm 1-hour average[a] | 0.12 ppm 1-hour average[a] |
| Lead | 1.5 $\mu g/m^3$ 90-day average | 1.5 $\mu g/m^3$ calendar quarter average | None |
| Foliar fluoride | 35 $\mu g/g$ grazing season average | None | None |
| Hydrogen sulfide | 0.05 ppm hourly average[a] | None | None |
| Settled particulate (dustfall) | 10 $g/m^2$ 30 day average | None | None |
| Visibility | $3 \times 10^{-5}$ per meter - nephelometer[c] | None | None |

$\mu g/m^3$ = micrograms pollutant per cubic meter of sampled air
ppm = parts per million

[a]Not to be exceeded more than once per year
[b]Not to be exceeded more than 18 times per year
[c]Applies to PSD mandatory Class I areas
Source: Montana Air Quality Bureau 1989

TABLE 3.9-3

MEAN, MAXIMUM, AND AVERAGE MONTHLY TEMPERATURES (°F)
FOR THE PROJECT AREA

| Sample Period | Mean Minimum | Mean Maximum | Average |
|---|---|---|---|
| October 1981 | 30.1 | 48.3 | 38.2 |
| November 1981 | 29.6 | 52.2 | 38.4 |
| December 1981 | 21.9 | 36.5 | 29.3 |
| January 1982 | 16.8 | 37.2 | 26.4 |
| February 1982 | 20.3 | 39.1 | 28.1 |
| March 1982 | 19.7 | 34.7 | 27.6 |
| April 1982 | 22.0 | 41.8 | 31.0 |
| May 1982 | 28.9 | 48.2 | 39.7 |
| June 1982 | 35.9 | 55.3 | 45.9 |
| July 1982 | 42.9 | 64.4 | 54.0 |
| August 1982 | 44.3 | 70.9 | 57.7 |
| September 1982 | 36.4 | 56.1 | 45.1 |
| Period of Record | 29.1 | 48.7 | 38.4 |

Source: Beak Consultants 1983a

TABLE 3.9-4

PRECIPITATION TOTALS (INCHES) MEASURED
AT THE PROJECT AREA

| Month | 1981-1982 | 1988-1989 |
|---|---|---|
| October | 0.24 | 2.32 |
| November | 0.21 | 1.04 |
| December | 0.49 | 1.40 |
| January | 6.04 | 0.77 |
| February | 1.05 | 0.85 |
| March | 1.29 | 2.15 |
| April | 2.63 | 2.40 |
| May | 2.23 | 4.39 |
| June | 3.07 | 2.95 |
| July | 0.33 | 1.85 |
| August | 1.34 | 2.03 |
| September | 1.59 | 0.81 |
| Annual | 20.51 | 22.96 |

Source: SPGMR 1990

Wind data have been collected in the project area in 1981 to 1982 and 1988 to 1989. Figure 3.9-1 presents the wind rose for the site for the monitoring year November 1988 through November 1989. The wind rose depicts the percentage of time that the wind blows from a particular direction in a certain wind speed class. Table 3.9-5 summarizes average wind speed and most frequent wind directions by month during the monitoring year. The most common wind direction was from the south, which occurred 22 percent of the time. A secondary maximum occurred from the west, occurring 12 percent of the time. The predominance of a strong down-valley (from the south) wind pattern would help to disperse emissions from the mine away from the primary concern area, the Absaroka-Beartooth Wilderness. The average annual wind speed at the monitoring site was 8.6 miles per hour (mph). November was the windiest month, with an average of 10.1 mph. The winter months had the highest wind speeds during the monitoring year. Calm conditions were recorded only 1.2 percent of the time. Atmospheric stability data, in the form of sigma theta values, were collected by Beak Consultants during the 1981 - 1982 monitoring year (Beak 1983a). The hourly averages of atmospheric stability provide an indication of the pollutant dispersion potential of the atmosphere, Sigma theta represents the standard deviation of the horizontal wind direction fluctuations. The Mitchell-Timbre stability classification scheme assigns atmospheric stability categories based on sigma theta values. These categories range from A (unstable) to F (stable). Table 3.9-6 summarizes the recorded stability categories in the project area. Unstable categories (A, B, and C) occurred 39.1 percent of the time, neutral conditions (D) 18.3 percent of the time, and stable conditions 42.6 percent of the time during the monitoring year.

Mixing height and inversion data were also collected in 1981 - 1982 (Beak 1983a). These data show that low-level inversions below 500 feet occur about half the time in the project area. Generally, the inversions are stronger and deeper in the fall and winter months.

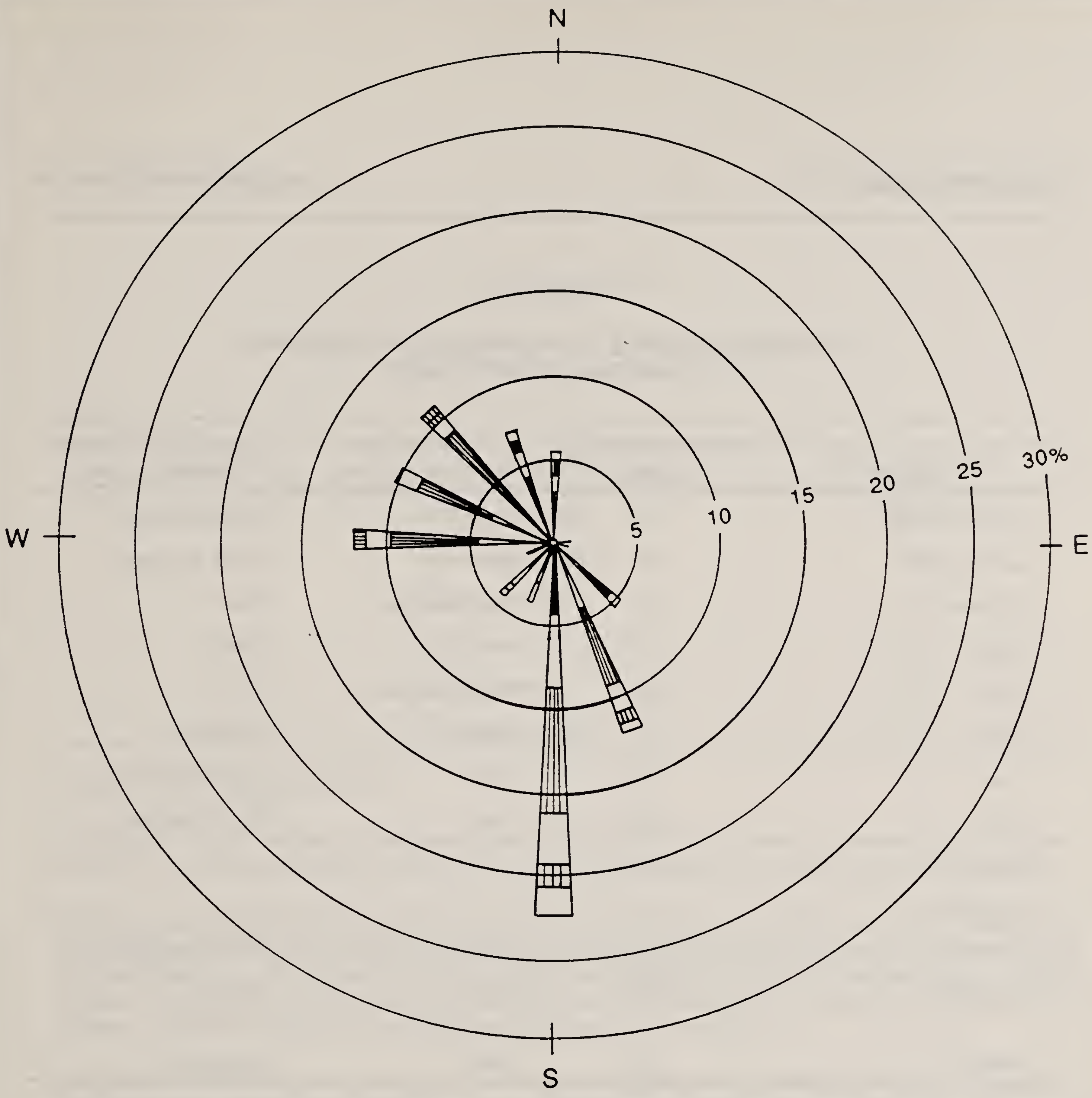
## 3.10 ROADS AND TRANSPORTATION

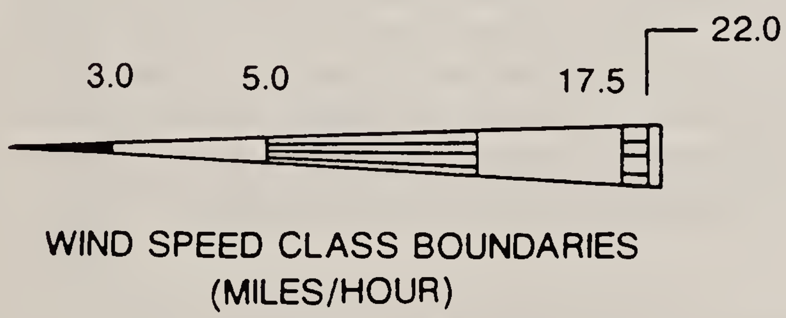
The transportation section provides information for a study area which is defined as all major transportation routes which may be affected by the project. Data sources for this study include various maps and literature supplied by private, state, county, and federal agencies, and personal communication with the Sweet Grass County Planning Office, the Montana State Department of Highways, and the Big Timber Ranger District.

The regional transportation network serving south-central Montana includes an established system of interstate, state, county, and Forest Service highways and roads. Montana Rail Link operates a railroad line through the region, and the Big Timber airport provides limited air service to the local area. Roads which would be affected by the proposed project include Federal Aid Secondary (FAS) 298, Sweet Grass (SG) County road 31, and Forest Service (FS) road 205. FS 140 (Picket Pin road) will be used to access the Placer Basin permit area, and SG 30 and Park County road 29 may see some increase in use if workers commute from Livingston. Interstate 90 serves as the main east-west transportation route in the region. U.S. 10 parallels Interstate 90, and U.S. 191 extends from Big Timber north.

### 3.10.1 Roads

Interstate 90 (I-90) is the primary arterial for east-west traffic in the county. From Big Timber I-90 provides direct access to Billings to the east, and to Livingston and Bozeman to the west. I-90 is a 4-lane, paved freeway and serves both intrastate and local interstate passenger and freight traffic. Average daily traffic (ADT) figures for I-90 show that in 1987 the ADT east of Big Timber was 5,679, and was 5,376 west of Big Timber. Average daily traffic is the total volume of traffic for both directions over a 24-hour period at a




NOTES:

DIAGRAM OF THE FREQUENCY OF OCCURENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE - WIND IS BLOWING FROM THE NORTH 5.5 PERCENT OF THE TIME.

EAST BOULDER WINDROSE 1989

**FIGURE 3.9-1**

TABLE 3.9-5

AVERAGE MONTHLY WIND SPEED AND DIRECTION
FOR THE PROJECT AREA

| Month | Average Wind Speed (mph) | Most Frequent Wind Direction | Second Most Frequent Wind Direction |
|---|---|---|---|
| December 1988 | 6.4 | South | South southeast |
| January 1989 | 8.0 | South | North northwest |
| February | 2.3 | West northwest | West |
| March | 2.3 | West | South |
| April | 2.5 | West northwest | West |
| May | 2.3 | South | Northwest |
| June | 1.8 | South | South southeast |
| July | 3.8 | South | South southwest |
| August | ---[a] | --- | --- |
| September | --- | --- | --- |
| October | 8.0 | South | South southeast |
| November | 10.1 | South | West |
| Annual | 8.6 | South | Southeast |

[a] Missing data

Source: Gelhaus 1990

TABLE 3.9-6

PERCENT OCCURRENCE OF STABILITY CATEGORIES
WITHIN PROJECT AREA, 1981-1982

| Stability Class | Stability Description | Percent Occurrence |
|---|---|---|
| A | Extremely unstable | 29.1 |
| B | Moderately unstable | 6.7 |
| C | Slightly unstable | 3.3 |
| D | Neutral | 18.3 |
| E | Slightly stable | 9.9 |
| F | Moderately stable | 32.7 |

Source: Beak Consultants 1983a

given location on the roadway. Through the years 1985-1987 the ADT volumes has shown a steady increase. Table 3.10-1 provides a listing of ADTs and other road characteristics for roads affected by the project.

With the completion of I-90, U.S. 10 has now been categorized as a frontage road which parallels I-90 through most of the county. Except for the business loop through Big Timber, this road has been redesigned as a state highway. The segment of U.S. 10 which runs through Big Timber functions now as a minor arterial. U.S. 191 is a two-lane, paved highway which provides access to the northern half of Sweet Grass County. It connects with U.S. 12 at Harlowton and with U.S. 2 at Malta.

FAS 298 (Main Boulder River Road) is a two-lane paved highway which extends 25 miles southwest from Big Timber along the Main Boulder River. At the GNF boundary the road becomes FS 212 and continues south into GNF, accessing several campgrounds, fishing areas, and private lands along the Main Boulder River. FAS 298 is in poor condition, that is the riding qualities are not tolerable in some places for high speed traffic, and may be uncomfortable for medium speed traffic. In addition, pavement defects may include extensive rutting, map cracking, and extensive patching. Curbs, gutters, or ditches may not function or may not exist. The state highway department has plans to overlay portions of the highway with new asphalt. This highway was built in the 1930s and was not constructed to handle large volumes of heavy truck traffic.

SG 31 (East Boulder River Road) provides access to the proposed East Boulder permit area and the Elk Creek drainage. The county maintains the road to the GNF boundary, at which point the road becomes FS 205. SG 31 is a gravel road, varying approximately from 14 to 20 feet wide and constructed of native materials. Annual ADT was 110 in 1989. This road and FAS 298 are occasionally used by local ranchers to move livestock, and the roads themselves are in close proximity to several homes and ranches along the routes. Traffic counts on FS 205 show that in 1989, annual ADT was 18. Traffic levels on both SG 31 and

TABLE 3.10-1

MAJOR ROAD ACCESS

| | Jurisdiction | ADT | Year | Surface Type | Condition |
|---|---|---|---|---|---|
| Interstate 90[a] | | | | | |
| West of Big Timber | Federal | 5376<br>4908<br>4845 | 1987<br>1986<br>1985 | Paved | Good |
| East of Big Timber | Federal | 5679<br>5359<br>4939 | 1987<br>1986<br>1985 | Paved | Good |
| FAS 298[a] | | | | | |
| Junction of FAS 298 & FAP 91 (In town of Big Timber) | State | 1462<br>1394<br>1741 | 1987<br>1986<br>1985 | Paved | Good |
| 24 mile section from city limits to GNF boundary | State | 392<br>505<br>409 | 1987<br>1986<br>1985 | Paved | Poor |
| SG 31[b] | | | | | |
| Traffic counts at Main Boulder River bridge | County | 90[b] | 1989 | Gravel | Fair |
| FS 205[b] | | | | | |
| Traffic counts at GNF Boundary | Forest Service | 18[b] | 1989 | Gravel | Fair/ Good |

ADT = Average Daily Traffic
FAS = Federal Aid Secondary
FAP = Federal Aid Primary
GNF = Gallatin National Forest
SG = Sweet Grass County
FS = Forest Service

[a] ADT by section, Mt. Dept. of Highways
[b] Estimated year round ADT

Sources: Colbert 1990.
Lutey 1990.
Kreuger 1990a
Sweet Grass County Planning Department

FS 205 have generally increased since 1982, due in most part, to increased logging activity, mine exploration, and recreational use in the East Boulder River valley. Park County road 29 (Swingley Road) is a gravel road in good condition up to the intersection with Mission road, from that point to the West Boulder River the road is in fair condition. Sweet Grass road 30, which follows along the West Boulder River, is a gravel road in fair condition. Good condition is defined as having adequate width for safe passage of large vehicles; a uniform cross-section with a crown and ditches to provide good drainage; smooth surface with no washboards, rutting, or soft areas; adequate gravel uniformly spread across the surface; and support of traffic during wet weather. Fair condition is defined as having adequate width for safe passage of cars and pick-up trucks; drainage which is not adequate; surface with occasional washboards and ruts but which do not interfere with safe vehicle operation; gravel present but lacking in the wheel paths or short trenches; and puddles and slippery surface during wet weather.

### 3.10.2 Bridges

There are three bridges on FAS 298 between Big Timber and the East Boulder River Road. All three bridges have operating capacities which exceed the maximum legal loads allowed without a special permit, and structural conditions exceed current minimum State of Montana criteria. Between FAS 298 and the proposed mine site there are seven bridges that must be crossed on SG 31. Table 3.10-2 gives a description of these bridges. The bridges on SG 31 would all require varying degrees of improvement to handle the heaviest anticipated load associated with the proposed project.

### 3.10.3 Other Transportation

The Montana Rail link passes through Sweet Grass County, paralleling I-90 for most of its length. There are no railroad crossings on the roads affected by the project. The Big Timber airport is approximately 3 miles southwest of Big Timber and encompasses 325 acres. It is jointly owned by Sweet Grass County and the City of Big Timber. There is a small air service company that operates at this airport, but there is no regular commercial commuter airline service. Airports at Billings and Bozeman provide regular air service and are capable of handling DC-10s and Boeing 747s.

## 3.11 LAND USE

The purpose of the land use resource study is to identify the existing land use surrounding the project area and, to a lesser extent, Sweet Grass County. Data sources include various maps and literature supplied by federal, state, county, and private agencies. This information was supplemented by personal communication with officials from the Sweet Grass County Planning Board and the GNF Big Timber Ranger District.

Land use in Sweet Grass County has evolved as a result of the natural environment and human economic and cultural activities. Agriculture (mostly livestock raising) has dominated the economy of Sweet Grass County, and the pattern of land use reflects this. Table 3.11-1 shows existing land use in the county. Although these data were generated some time ago (1976-79), they still accurately reflect the present condition (Langhus 1990c). Variations in acreage between the two inventories displayed in Table 3.11-1 are due to differences in criteria. On average, 75 percent of Sweet Grass county is classified as agriculture land. Of the remaining 25 percent, the majority is classified as forest, most of which is managed by the U.S. Forest Service.

TABLE 3.10-2

BRIDGES ALONG FAS 298 AND SG 31

| Bridge Location | River Bridge Crosses | Year Constructed | No. lanes | Roadway Width (feet) | Structure Type | Truck[a] Type | Inventory Rating (tons) | Operating Rating (tons) |
|---|---|---|---|---|---|---|---|---|
| FAS 298 | Main Boulder | 1975 | 2 | 31.5 | Pre-stressed | 3 | HS20[b] | 65 |
| 8.5 miles south of | River | | | | concrete | 3-S2 | | 86 |
| Big Timber | | | | | beam | 3-3 | | 99 |
| FAS 298 | Main Boulder | 1950 | 2 | 20.2 | Steel | 3 | H15[c] | 42 |
| 13 miles south of | River | | | | multiple | 3-S2 | | 64 |
| Big Timber | | | | | stringer | 3-3 | | 82 |
| FAS 298 | West Boulder | 1976 | 2 | 31.5 | Prestressed | 3 | HS20 | - |
| 17 miles south of | River | | | | concrete | 3-S2 | | - |
| Big Timber | | | | | beam | 3-3 | | 90 |
| SG 31 | Main Boulder | 1930 | 1 | 15.2 | Steel Truss | 3 | 9 | 13 |
| at mile 0.3 | River | | | | | 3-S2 | 14 | 20 |
| | | | | | | 3-3 | 18 | 25 |
| SG 31 | East Boulder | 1965 | 1 | 15.8 | Timber | 3 | 22 | 33 |
| at mile 1.1 | River | | | | bridge | 3-S2 | 37 | 53 |
| | | | | | | 3-3 | 43 | 43 |
| SG 31 | Elk Creek | -- | 1 | -- | Timber | 3 | 12 | -- |
| at mile 3.2 | | | | | bridge | 3-S2 | 20 | -- |
| | | | | | | 3-3 | 21 | -- |
| SG 31 | East Boulder | 1967 | 1 | 15.5 | Timber | 3 | 17 | 26 |
| at mile 3.4 | River | | | | bridge | 3-S2 | 25 | 38 |
| | | | | | | 3-3 | 32 | 48 |
| SG 31 | East Boulder | 1969 | 1 | 15.8 | Timber | 3 | 17 | 23 |
| at mile 4.6 | River | | | | bridge | 3-S2 | 39 | 52 |
| | | | | | | 3-3 | 36 | 49 |

TABLE 3.10-2
(Concluded)

| Bridge Location | River Bridge Crosses | Year Constructed | No. lanes | Roadway Width (feet) | Structure Type | Truck[a] Type | Inventory Rating (tons) | Operating Rating (tons) |
|---|---|---|---|---|---|---|---|---|
| SG 31 at mile 5.2 | East Boulder River | 1971 | 1 | 19 | Timber bridge | 3 | 15 | 20 |
| | | | | | | 3-S2 | 27 | 39 |
| | | | | | | 3-3 | 32 | 43 |
| SG 31 at mile 6.0 | Mason Ditch | -- | 1 | | Timber bridge | 3 | 9 | -- |
| | | | | | | 3-S2 | 14 | -- |
| | | | | | | 3-3 | 15 | -- |

FAS = Federal Aid Secondary
SG = Sweet Grass County
[a] Maximum legal load for each vehicle type = 3 (3 axle truck) 25T; 3-S2 (3 axle tractor and trailer) 36 T; 3-3 (3 axle truck and trailer) 40T
[b] HS20 denotes a standard truck weight of 72,000 lbs, used in designing bridges.
[c] H15 denotes a standard truck weight of 54,000 lbs, used in designing bridges.

Source: Meyer 1990.

TABLE 3.11-1

LAND USE IN SWEET GRASS COUNTY

| Category | SGC (acres)[a] | SCS (acres)[b] |
|---|---|---|
| Irrigated | 44,181 | -- |
| Cropland | -- | 84,507 |
| Dry cropland | 50,058 | -- |
| Pasture | -- | 41,889 |
| Range | 763,824 | 640,170 |
| Forest | 319,577 | 103,994 |
| Other[c] | 13,800 | 2,860 |
| Total | 1,181,440 | 874,230 |

[a] Sweet Grass County Planning Board 1978.
[b] SCS 1976 (Data are only for private and state lands.)
[c] Urban and built up water areas.

Sweet Grass County Growth Policy Plan (Plan) describes its policies toward land use for both the lower and upper Main Boulder River areas. The Plan emphasizes the maintenance of the present rural and recreational use of the area. The Sweet Grass County Planning Board recognizes that there may be a potential need for mineral exploration and urges that this work be carried out with environmental safeguards in place. The Growth Policy Plan has several land use categories. A designation of resource lands is given to lands not suitable for development because of slope, soil limitations, or hydrologic or geologic hazards. It is also given to protect areas of natural resource production. Priority I is a subclassification of resource lands, given to irrigated acreage. These lands are recommended for continued agriculture production. Most of the land adjacent along both the Main Boulder and East Boulder Rivers, up to the GNF boundary, have been classified as Priority I lands. This includes the irrigated hill and bench lands west of the East Boulder River. There are five private inholdings along the East Boulder River within the GNF. The land use of these properties is primarily agricultural/grazing/croplands (hay meadows).

Land ownership in Sweet Grass County has not changed substantially since the 1976 assessment done by the Soil Conservation Service (Murphy 1990). Results of that assessment are provided in Table 3.11-2. The table shows that about 71 percent of the land is in private and local government, and about 23 percent is controlled by the U.S. Forest Service. The remainder is state, BLM, and small water areas.

TABLE 3.11-2
LAND OWNERSHIP IN SWEET GRASS COUNTY

| Jurisdiction | Acres | Percent Of County |
|---|---|---|
| Private & Local Government | 840,410 | 71 |
| State | 49,280 | 4 |
| National Forest | 276,250 | 23 |
| Bureau of Land Management | 14,960 | 1.3 |
| Fish and Wildlife | -- | |
| Small Water Areas | 540 | .7 |
| Private and Others | -- | |
| Total | 1,181,440 | 100 |

Source: SCS 1976.

The majority of land in the vicinity of the project area is under the jurisdiction of the GNF Big Timber Ranger District. These lands have been divided up into various management areas (MAs), each with its own management objectives and goals. In addition to forest wide standards, these MAs provide direction for land use decisions. Figure 3.11-1 shows the different management areas in the study area. Land in the vicinity of the project sites include parts of MAs 1, 3, 6, 8, 11, 12, 16, 17, and 24. A brief description of the management objectives of these MAs are provided in Table 3.11-3.

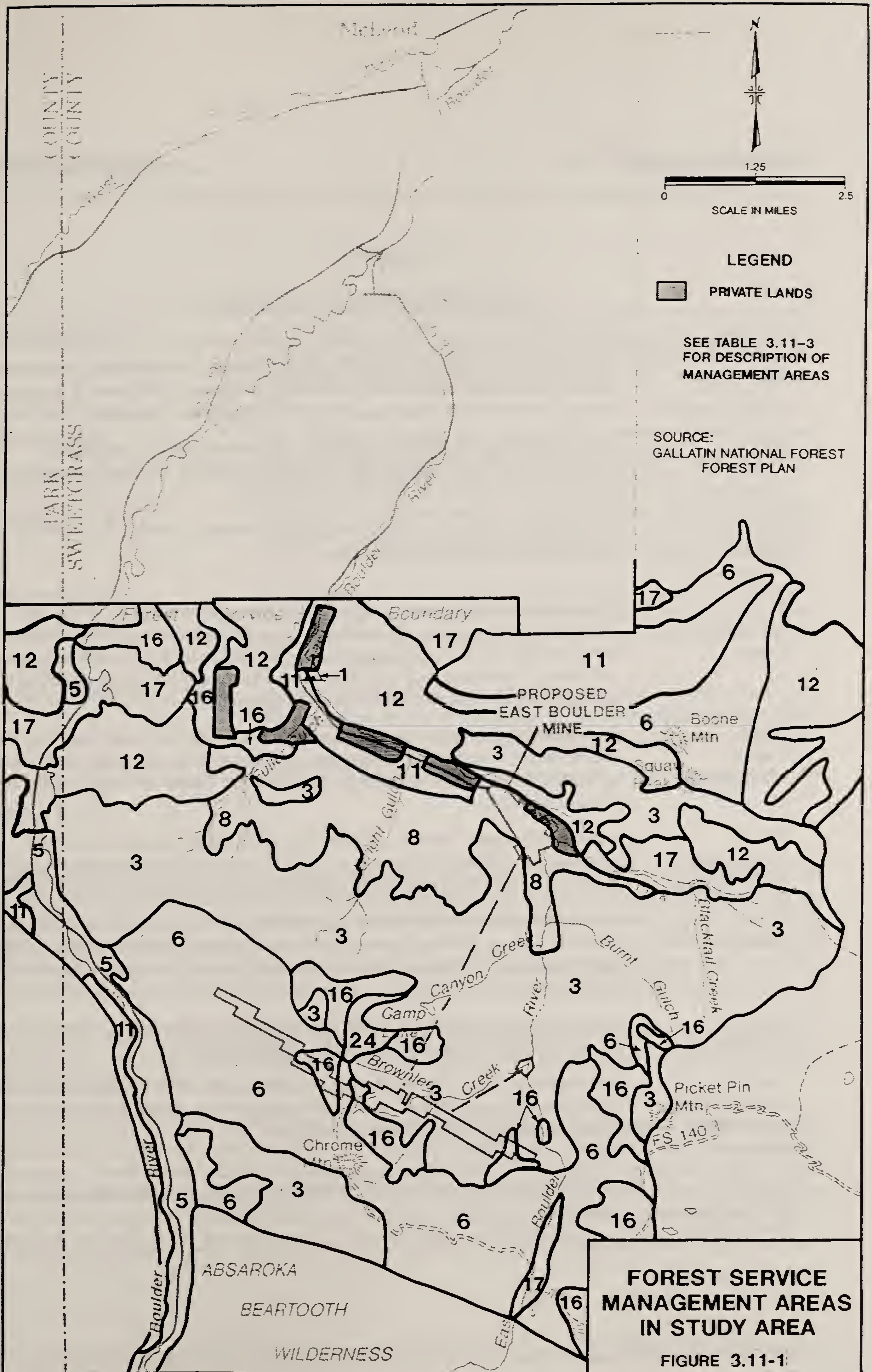
The East Boulder adit site is in MA 8, which is a timber management area. Lodgepole pine has been harvested on about 17 acres in the proximity of the adit site. GNF has completed a timber sale in the Lewis Gulch area, southwest of the adit site. There is one active grazing allotment in the area, the Dry Fork allotment, which runs 94 cows each year from July 1st to September 30th. The cattle are trailed up the East Boulder River Road to the allotment area in the Dry Fork drainage. There is a sheep allotment on the East Boulder Plateau which is not currently being used and has not been for several years. Recreational uses of the land are described in Recreation and Wilderness, Subsection 3.13.

### 3.12 VISUAL RESOURCES

The purpose of the visual resources investigation is to identify and describe visual resources which could be affected by the construction and operation of the proposed project. The area evaluated includes landscapes potentially affected by the proposed permit areas and the alternative road and transmission corridors. Visual resources are described using the U.S. Forest Service Visual Management System (VMS). This is a methodology developed by the U.S. Forest Service for describing and managing visual resources in national forests. It includes inventories of variety classes, sensitivity levels, distance zones, visual quality objectives, and visual absorption capability. Information on visual resources in the study area (those viewsheds potentially affected by the proposed action or alternatives) was taken from the Gallatin National Forest Plan, Beak Consultant's Stillwater Project Technical Report No. 15, and supplemented by visual resource investigations performed by Woodward-Clyde Consultants.

Variety classes are obtained by evaluating landscape features, such as topography, rock and water forms, and vegetative patterns. For a frame of reference, these physical features are compared with those commonly found in the surrounding physiographic region. The actual classifications are based on the premise that those landscapes with the most variety or diversity have the greatest potential for scenic quality. Sensitivity levels are a measure of the visibility of the landscape from travel routes, use areas, and water bodies. Distance zones are divisions of the landscape being viewed and are generally categorized as foreground (0 - 1/2 mi.) middle ground, (1/2 - 3 to 5 mi.), and background (from middle ground to infinity).

Visual quality objectives (VQOs) set standards or goals from the visual management of the landscape and are assigned on the basis of the variety class, sensitivity level, and distance zone analysis. There are five VQOs, each describing a different degree of acceptable alteration of the natural landscape. The degree of alteration is measured in terms of visual contrast with the surrounding landscape. The five visual quality objectives are preservation (P), retention (R), partial retention (PR), modification (M), and maximum modification (MM). See Table 3.12-1 for an explanation of these VQOs.




**FOREST SERVICE MANAGEMENT AREAS IN STUDY AREA**

**FIGURE 3.11-1**

TABLE 3.11-3

MANAGEMENT AREAS AFFECTED

| | |
|---|---|
| MA 1 Developed Recreation Sites | Areas already developed for human activity include campgrounds, picnic areas, etc. as well as sites suitable for potential development. This area is managed for safety and enjoyment of users, and to provide additional facilities where needed. |
| MA 3 Unsuitable Recreation | Lands unsuitable for timber production. Characterized by topographic constraints and poor accessibility. Managed to protect existing improvements and resource - land to be left in a natural state. |
| MA 6 Dispersed Recreation | Undeveloped land with a trail system and few roads. Provide for a variety of dispersed recreational opportunities. |
| MA 7 Riparian Zones | These include riparian zones; areas where transported water provides soil moisture in excess of what is available to support a moist vegetation regime. Lands within this management area are suitable for timber harvest as long as soil, water, vegetation, fish and dependent wildlife species are protected and are adjacent to areas suitable for timber management. |
| MA 8 Timber Management | Lands suitable for timber management, with some inclusions of nonforest and nonproductive forest lands. Managed for productive timber stands and other resources if compatible with timber management. Maintain water quality and channel stability. |
| MA 11 Forested Big Game Habitat | Available for timber harvest provided big game habitat objectives are met. Managed to maintain elk habitat, to provide vegetative characteristics needed by the featured wildlife species and to maintain water quality and stream stability. |
| MA 12 Wildlife Habitat | Important habitat for summer or winter wildlife use in a variety of terrain and vegetative types. Offers dispersed recreation opportunities. Managed for wildlife habitat, dispersed recreation and for livestock forage if consistent with wildlife objective. |
| MA 16 Livestock Use | Open grasslands interspersed with non-productive timber lands. Contain some of the most productive and heavily used range allotments. |
| MA 17 Livestock Range and Wildlife Habitat | Grasslands or nonproductive forests, suitable for livestock grazing and contains important big game habitat. Managed to improve or maintain conditions for forage production for livestock and wildlife. |
| MA 24 Mineral Resource Development | Includes active or recently active mineral extraction, processing and exploratory operations. |

Source: FS 1987a

TABLE 3.12-1

VISUAL QUALITY OBJECTIVES

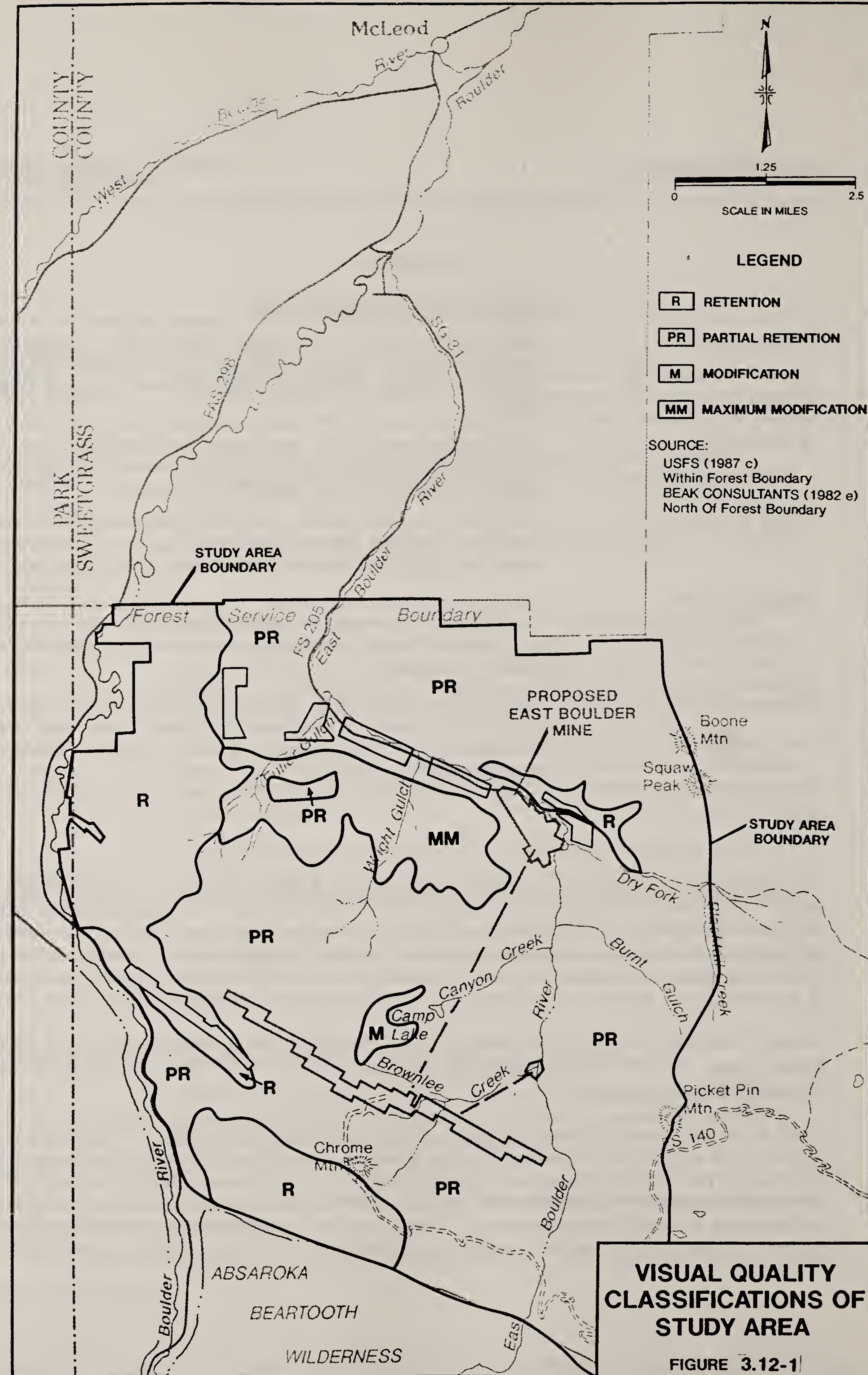
| | |
|---|---|
| Preservation (P) | This objective allows for ecological changes only. Management activities, except for very low visual impact recreation facilities, are prohibited. Applies to wilderness areas and other special or unique areas. |
| Retention (R) | This objective provides for management activities which are not visually evident. Activities may only repeat the form, line, color, and texture of those found in the characteristic landscape. |
| Partial retention (PR) | Management activities remain visually subordinate to the characteristic landscape. Activities may introduce form, line, color, and texture, which are not common to the area but must not dominate the view. |
| Modification (M) | Management activities may visually dominate the landscape; however, these activities must repeat the naturally established form, line, color, and texture so that its visual characteristics are compatible with the natural surroundings. |
| Maximum Modification (MM) | Management activities may dominate the characteristic landscape; however, when viewed as background, the visual characteristics of the disturbance should copy those of natural occurrence within the surrounding area. |

Source: FS 1987a

Visual absorption capability (VAC) is another concept the U.S. Forest Service uses in its visual management system. VAC provides an indication of the relative ability of the landscape to absorb visual impact without being substantially altered. It is based on consideration of slope, vegetation screening potential, vegetation regeneration potential, sensitivity, and color contrast between vegetation and soils, among other factors. VAC classifications are high, medium, and low, with a high VAC meaning that the physical characteristics of the landscape are such that it could absorb a potential visual impact without being substantially altered.

Cultural modifications to the natural landscape include residences and agricultural lands along the East Boulder River. On GNF lands, logging activity has taken place in the Lewis Gulch area and in the vicinity of the East Boulder permit area.

VQOs in the study area range from Retention to Maximum Modification. See Figure 3.12-1 for the VQOs assigned to the area. At the confluence of the East Boulder and Main Boulder Rivers, the landscape is rated as retention. The river valley keeps this designation south to the GNF boundary. Most of the land on either side of this section of river is rated as partial retention. The VQO designations north of the GNF boundary are taken from the Beak Technical Report #15. VQOs on GNF lands in the study area were revised in 1987 by the U.S. Forest Service, and these ratings are used from the GNF boundary south.



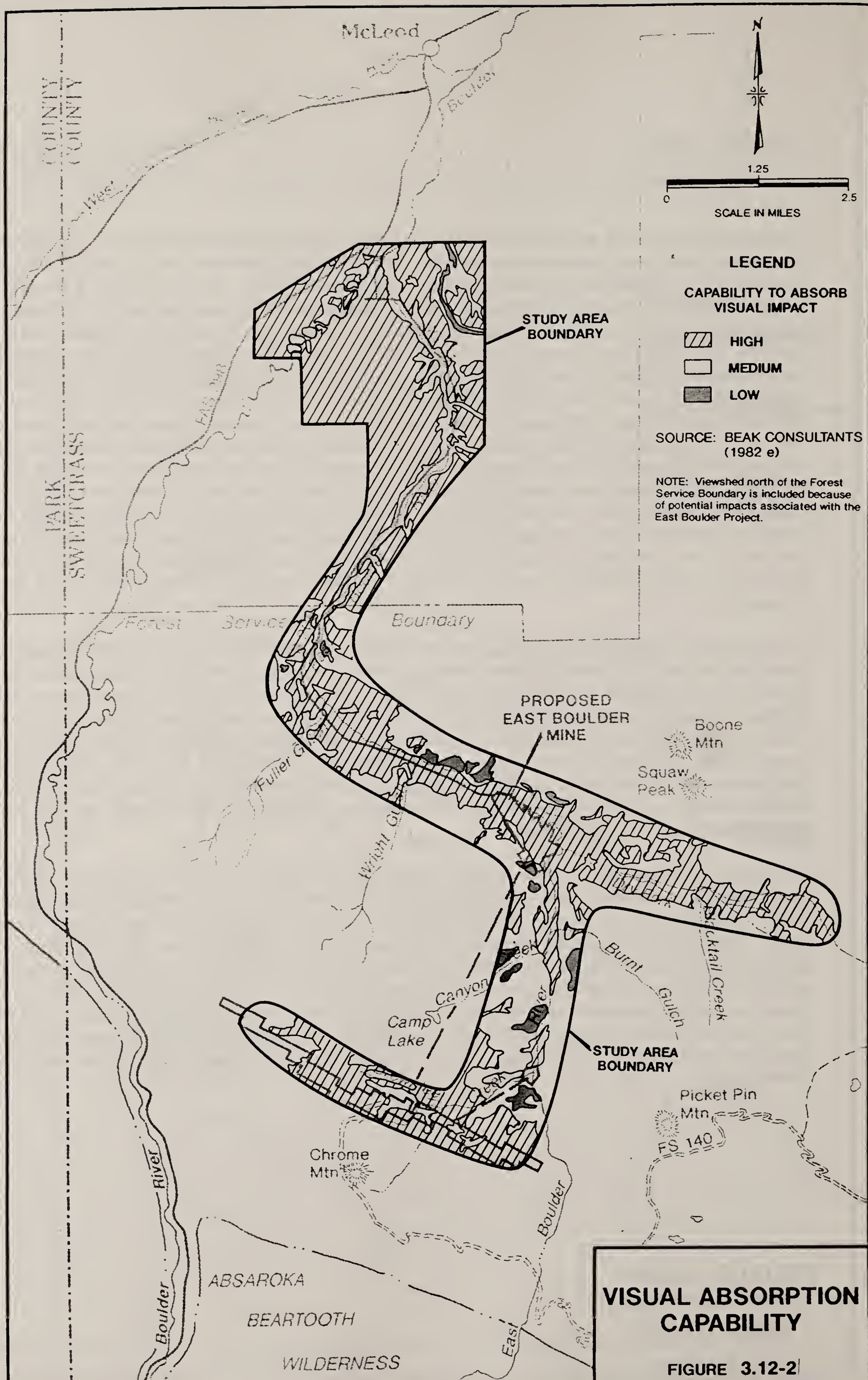

**VISUAL QUALITY CLASSIFICATIONS OF STUDY AREA**

FIGURE 3.12-1

Landscape character type is a unit of physiographic area having common characteristics of landforms, rock formations, water forms, and vegetative patterns. The landscape character by which scenic quality is judged is based upon descriptions in Fenneman (1931) and Atwood (1940). The project site is located on the northern edge of the Beartooth Mountains which themselves define the northern end of the Middle Rocky Mountain Province. The study area has a diverse range of landscapes, including high rugged peaks, rolling foothills, and river valley bottoms. North of the GNF boundary, the terrain above the river bottomland is characterized by rolling hills with gradual changes in slope and little variety in vegetative patterns. As the East Boulder River valley winds through this landscape, it creates a strong contrast in line, color, and texture and adds visual interest to the scene. South of the GNF boundary, the character of the landscape changes. The river valley narrows, the landforms become more prominent, and the mountainsides are heavily forested. The uniform vegetative cover of lodgepole pine and Douglas-fir creates the dominant color and texture of the landscape. The dark green color of the front is interrupted by gray-colored outcrops of upturned, tilted strata of sedimentary rocks. A glacial moraine separates the East Boulder River valley from Dry Fork, at which point the river turns south and the valley narrows into a steep-sided canyon, with glacial till deposits and areas of talus rock slopes. The East Boulder Plateau and Placer Basin, at the southern end of the study area, have a comparatively level terrain with vegetation characteristics of a forest and meadow subalpine ecosystem.

All of the project permit areas, including the East Boulder, the Brownlee Creek, and the Placer Basin permit areas are on lands designated as partial retention. Private inholdings in the GNF are not rated; however, most of the land adjacent to these areas is rated as partial retention. Retention is found north of the East Boulder permit area along a portion of the East Boulder River and extends around the private inholding on Dry Fork. Maximum modification is found to the west of the East Boulder permit area in the area around Fuller and Lewis Gulches, which roughly correspond to GNF MA 8, the timber management area. Further west toward the Main Boulder River, areas classified as retention are found and extend south across Graham Creek. A pocket of land classified as modification is found about one-half mile west of Camp Lake on the headwaters of Canyon Creek.

The northern portion of the study area (north of the GNF boundary) is generally classified as having a high visual absorption capability (VAC) due to gentle slopes and plant communities that have a high regeneration potential (Figure 3.12-2). South of the GNF boundary about half of the area is classified as having a high VAC. These areas are generally the valley bottom and the East Boulder Plateau which are areas of more gentle slopes. The East Boulder permit area is situated in an area of high VAC. Areas of steep slopes of scree or rock without revegetation potential are given a low VAC classification. These areas occur mostly in the Canyon and Brownlee Creek drainages. Areas classified as medium VAC may include areas of fairly steep slope with vegetative cover and have the capability of some regeneration. The Brownlee Creek permit area is in a medium VAC classification. The Placer Basin permit area includes both medium and high VAC classifications.




VISUAL ABSORPTION CAPABILITY

FIGURE 3.12-2

### 3.13 RECREATION AND WILDERNESS

The objectives of the recreational resource study are to identify recreation resources in the vicinity of the project area which may be affected by the proposed development. Information was compiled from maps and literature supplied by public and private agencies and from meetings and telephone communications with federal, state, county, and community officials.

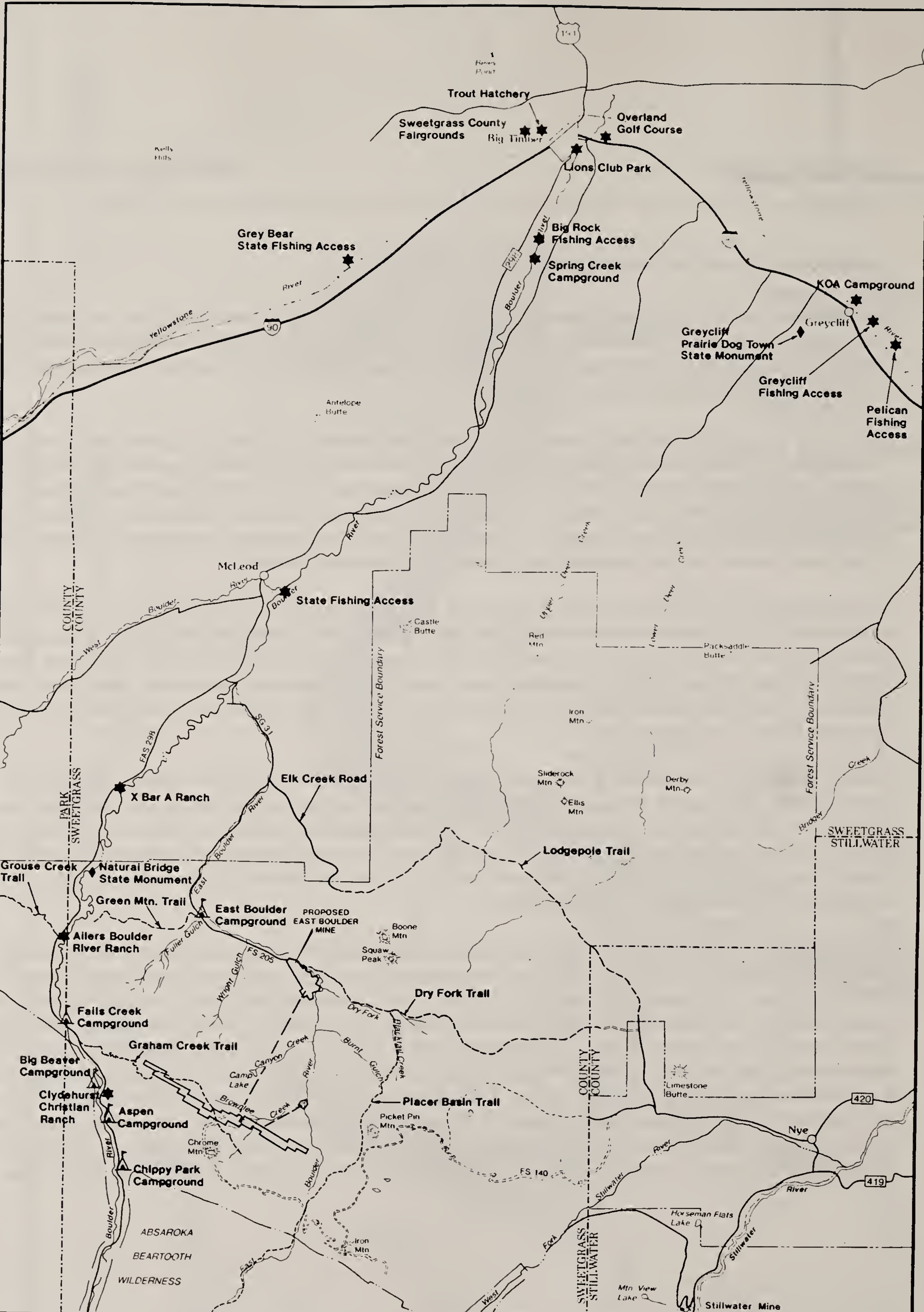
The study area is defined with recreation opportunities existing at both a regional and local level. Yellowstone National Park is approximately 90 highway miles from Big Timber. It is about 30 miles directly south of the Placer Basin permit area. Yellowstone National Park is one of the country's most heavily used national parks and provides for many recreational experiences, including sightseeing, viewing wildlife, picnicking, hiking, fishing, and camping. National forest lands occupy about one quarter of Sweet Grass County and provide for both dispersed and developed recreational activities.

The GNF Big Timber Ranger District, manages the land at the project site (Figure 3.13-1). GNF receives an estimated 2.25 million recreation visitor days (RVD[1]) each year. Approximately 2/3 of these visits are for dispersed uses and 1/3 are at developed sites. Dispersed recreation activities on the Big Timber Ranger District include fishing, hunting, picnicking, auto travel and sightseeing, horseback riding, and hiking. Table 3.13-1 generally summarizes recreation resources available in the area surrounding and/or near the proposed project location.

Winter uses include snowmobiling and cross-country skiing. Table 3.13-2 shows a listing of activities and RVDs for the Big Timber Ranger District. Ten campgrounds on federal and private lands are easily accessible from Big Timber. For the most part, these campgrounds tend to be underutilized most of the year. The East Boulder campground is the smallest, and is the only developed campground on the East Boulder River. There is a dispersed campsite at the end of the East Boulder Road which is usually occupied on summer weekends and during hunting season.

The U.S. Forest Service uses Recreation Opportunity Spectrum (ROS) classes as a framework for stratifying and defining classes of outdoor recreation environments, activities, and experience opportunities. See Table 3.13-3 for definitions of the six ROS settings, one for summer and one for winter, reflecting the seasonal changes in environment and activity and experience opportunities. During the summer season, the Forest Service has classified the East Boulder River valley as rural, from the GNF boundary to approximately one third of a mile south of the confluence of the Dry Fork with the East Boulder River. The East Boulder permit area is within this rural classification. The Forest Service is managing the area surrounding the mine adit as Roaded Natural (RN) and Roaded Modified (RM). South of the permit area the ROS classification changes to Semi-Primitive Motorized (SPM). The Brownlee Creek permit area is within the SPM setting. The area served by the Picket Pin road is classified as RM. The Placer Basin

[1] One recreation visitor day is defined by an amount of time, usually 12 hours, spent in recreational activity. For instance, 1 RVD would be one person recreating for 12 hours; 2 people recreating for 6 hours each would also add up to 1 RVD.




LEGEND

RECREATION SITES, FOREST SERVICE

RECREATION SITES

TRAIL

SOURCE: GALLATIN NATIONAL FOREST

**RECREATION SITES**

FIGURE 3.13-1

TABLE 3.13-1

RECREATIONAL USE OPPORTUNITIES IN PROJECT VICINITY

| Recreation Resource | Jurisdiction | Primary Activities | Comments |
|---|---|---|---|
| Absaroka-Beartooth Wilderness | USFS[a] | Hiking, camping, hunting, fishing | Borders Yellowstone National Park. Contains grizzly bear habitat 2½ miles from project study area. |
| Allers Boulder River Ranch | Private | Fishing, horseback riding, hiking, swimming, hunting | A family operation since 1918. |
| Aspen Campground | USFS | Camping, fishing, hiking | Most used campground along the Main Boulder River. 10 units. |
| Big Beaver Campground | USFS | Camping, fishing | New developed campground with 5 sites. |
| Big Rocks Fishing Access | MDFWP[b] | Fishing, swimming | On Main Boulder River. |
| Boulder Fork Fishing Access | MDFWP | Fishing | On Main Boulder River. |
| Box Canyon Trailhead | USFS | Hiking, horseback riding, hunting | Trailhead & unloading ramp. |
| Braaten Fishing Access | MDFWP | Fishing, hiking, swimming | On Yellowstone River east of Big Timber. |
| Burnt Leather Ranch | Private | Fishing, hunting, riding, cookouts | On West Boulder River, 4 miles of private stream fishing. |
| Camp of the Boulder | Private | Hiking, sightseeing, retreats | Summer church camp. |
| Camp Mimaragish | Private | Hiking, sightseeing, retreats | Summer church camp. |
| Chippy Park Campground | USFS | Camping, fishing, hunting | Least developed of the Boulder campgrounds. 6 units. |
| City Club Lanes | Private | Bowling | 6 lanes. |
| Civic Center | Private | Volleyball, basketball, aerobics | Operated by a private association. |
| Clydehurst Campground | USFS | Camping, fishing | Semi-developed. No official campsites. |
| Clydehurst Christian Ranch | Private | Hiking, sightseeing, retreats | Summer church camp. |
| Counting Corral Campground | USFS | Camping, fishing | Semi-developed. No official campsites. |
| East Boulder Campground | USFS | Camping, fishing, hunting, picnicking | Small facility within study area. 6 units. |
| Falls Creek Campground | USFS | Camping, fishing, hiking, picnicking | 11 units. |

TABLE 3.13-1
(Continued)

| Recreation Resource | Jurisdiction | Primary Activities | Comments |
|---|---|---|---|
| Four Mile Station | USFS | Camping, fishing, hiking, picnicking | Rental cabin. |
| Glasston Lake Recreational Area | Public | Camping, boating, swimming | Private property but allows public use. |
| GNF Trails | USFS | Hunting, hiking, pack trips | Approximately 12.5 miles of trails in the East Boulder River area. |
| GNF Roadless Area 1371 | USFS | Hunting, hiking, pack trips | Approximately 146 sq. miles in vicinity of East Boulder Mine Project. |
| Gray Bear Fishing Access | MDFWP | Fishing, hiking, swimming, picnicking | On Yellowstone River west of Big Timber. |
| Greycliff Fishing Access | MDFWP | Fishing, hiking, swimming | On Yellowstone River east of Big Timber. |
| Half-moon Campground | USFS | Camping, fishing, hiking, hunting | North of Big Timber, provides access to Crazy Mountains, 9 units. |
| Hawley Mountain Guest Ranch | Private | Wilderness horseback rides, 4-wheel drive trips, fishing | Oriented to families and groups. |
| Hell's Canyon Campground | USFS | Camping, hiking, hunting | Located on a bluff above the river. The least used campground in the Main Boulder, 11 units |
| Hicks Park Campground | USFS | Camping, hiking, fishing, hunting | The last and largest campground up the Main Boulder, 27 units. |
| KOA Campground | Private | Camping, swimming | East of Big Timber on I-90. 79 RV/tent spaces. |
| Lazy K Bar Ranch | Private | Horseback riding, cattle work, overnight campouts | Working cattle ranch, one of the oldest in the area. |
| Lion Club Park | Public | Softball, tennis, picnicking | The only city park in Big Timber. |
| Lutheran Bible Camp | Private | Hiking, backpacking, sightseeing, retreats | Summer church camp. |
| Main Boulder Work Center | USFS | Hiking, horseback riding | Facility for USFS workcrews. Has an unloading ramp for horses and ORVs. |
| Natural Bridge and Falls | MDFWP & USFS | Scenic area, interpretive site walking | The actual natural Bridge collapsed in 1988. |

TABLE 3.13-1
(Concluded)

| Recreation Resource | Jurisdiction | Primary Activities | Comments |
|---|---|---|---|
| Overland Golf Course | Public | Golfing | County owns land, private business operates 9-hole golf course. |
| Pelican Fishing Access | MDFWP | Fishing, camping, picnicking | On Yellowstone River east of Big Timber. |
| Spring Creek Camp | Private | Camping, fishing, hiking | 75 RV/tent spaces. |
| Sweet Grass County Fairgrounds | Public | County fair, rodeos & other horse events | 31 acre site near Big Timber. |
| Sweet Grass Ranch | Private | Riding, ranch activities, fishing | On the National Register of Historic Places. |
| West Boulder Campground | USFS | Camping, hiking, fishing | Trailhead for several trails in area, 10 units |
| Whispering Pines Ranch | Private | Fishing, hiking, swimming | Small area with 3 cabins. |
| X Bar A Ranch | Private | Horseback riding, fishing, pack trips, swimming | Operating stock ranch. |
| Yellowstone National Park | NPS[c] | Sightseeing, wildlife observation, camping, hiking, fishing, etc. | One of the most popular National Parks, had 2,680,376 visitors in 1989. |
| Yellowstone Trout Hatchery | MDFWP | Tours of facility | Open to the public. |

[a] United States Forest Service
[b] Montana Department of Fish, Wildlife & Parks
[c] National Park Service

Source: Orr 1990; Cifala 1990; Becken 1990c; Yellowstone National Park 1990.

TABLE 3.13-2

ESTIMATE OF RECREATION VISITOR DAYS (RVDs) BY ACTIVITY
FOR THE BIG TIMBER RANGER DISTRICT (IN THOUSANDS)

| Activity | RVDs[a] | |
|---|---|---|
| | 1988[b] | 1989 |
| Winter Sports | 7.0 | 8.7 |
| Resorts, Cabins, & Organization Camps | 6.1 | 9.7 |
| Hunting | 15.0 | 21.3 |
| Fishing | 24.1 | 36.1 |
| Non-consumptive Fish & Wildlife Uses (i.e., Bird Watching, Photography) | 13.0 | 12.0 |
| Other Recreation Activities | 20.0 | 20.0 |
| Camping, Picnicking, & Swimming | 53.6 | 78.6 |
| Motorized Travel & Scenery Viewing | 48.3 | 71.0 |
| Hiking, Horseback Riding, and Float Boating | 41.1 | 61.4 |

[a] One RVD equals one person on the forest for 12 hours, or any combination of people and hours that equal 12 (for example, 4 people for three hours)
[b] Large differences between RVDs for 1988 and 1989 are due to forest closure in 1988. 1989 data may be more representative.
Source: GNF

TABLE 3.13-3
RECREATION OPPORTUNITY SPECTRUM CLASSES

URBAN
Urban ROS class settings are characterized by high levels of human activity and by concentrated development, including developments for recreation opportunities. In urban settings, levels of recreation use vary and can be extremely high or dense. There are a preponderance of signs and other indications of regulations on the users' behavior. The landscape is dominated by human structures, and green-space is only sporadically dominant.

RURAL
In the Rural class settings, the sights and sounds of human activity are readily evident, though less pronounced and less concentrated than in the Urban class. Levels of use vary, but do not reach those concentrations of the Urban class except at specialized and developed sites. While the characteristic landscape is often dominated by human-caused geometric patterns, there is also a dominant sense of open, green-space.

ROADED, NATURAL APPEARING
The Roaded Natural class is characterized by predominately natural-appearing settings with moderate sights and sounds of human activities and structures. The overall perception is one of naturalness. Evidence of human activity varies from area to area and includes improved highways, railroads, developed campgrounds, small resorts and ski areas, livestock grazing, timber harvesting operations, watershed restoration activities, and water diversion structures. Roads and motorized equipment and vehicles are common in this setting. Density of use is moderate except at specific developed sites, and regulations on user behavior are generally less evident than in Urban or Rural classes.

ROADED MODIFIED
A distinct subclass of setting features exists within the Roaded Natural class. This subclass occurs where human modification is locally dominant or codominant with a natural-appearing landscape, much like the rural setting. However, the recreation opportunities provided are significantly different from the Rural setting. For example, although numerous, highly improved roads might exist in this subclass, there may be a sense of remoteness because of the distances from major travelways. In addition, the density of recreation use is often low compared to the Rural class. Also, users have the opportunity for exploration and to use both on-road recreation vehicles and ORVs. Camping is not confined to developed campsites, so users have considerable autonomy in choosing sites and using equipment.

SEMI-PRIMITIVE
Both the Semi-Primitive Motorized and Semi-Primitive Non-Motorized classes are characterized by predominately natural or natural appearing landscapes. The size of these areas gives a strong feeling of remoteness from the more heavily used and developed areas. Within these settings there are ample opportunities to practice wildland skills and to achieve feelings of self-reliance. The most significant difference between the semi-primitive motorized and non-motorized settings is the presence or absence of motorized vehicles.

PRIMITIVE
The Primitive settings are characterized by essentially unmodified natural environments and their size and configuration assure remoteness from the sights and sounds of human activity. The use of motorized vehicles and equipment is not permitted except in extreme emergencies, such as preserving a life or the resource. In the Primitive class, the user is forced to be self reliant and expects low levels of user density.

Source: U.S. Forest Service

permit area includes lands that have been classified as both SPM and RM. During the winter season the ROS classifications generally indicate a more primitive setting. The rural classification extends from the GNF boundary south for approximately 1½ miles, where it changes to SPM. The Placer Basin permit area includes areas classified as primitive and SPM.

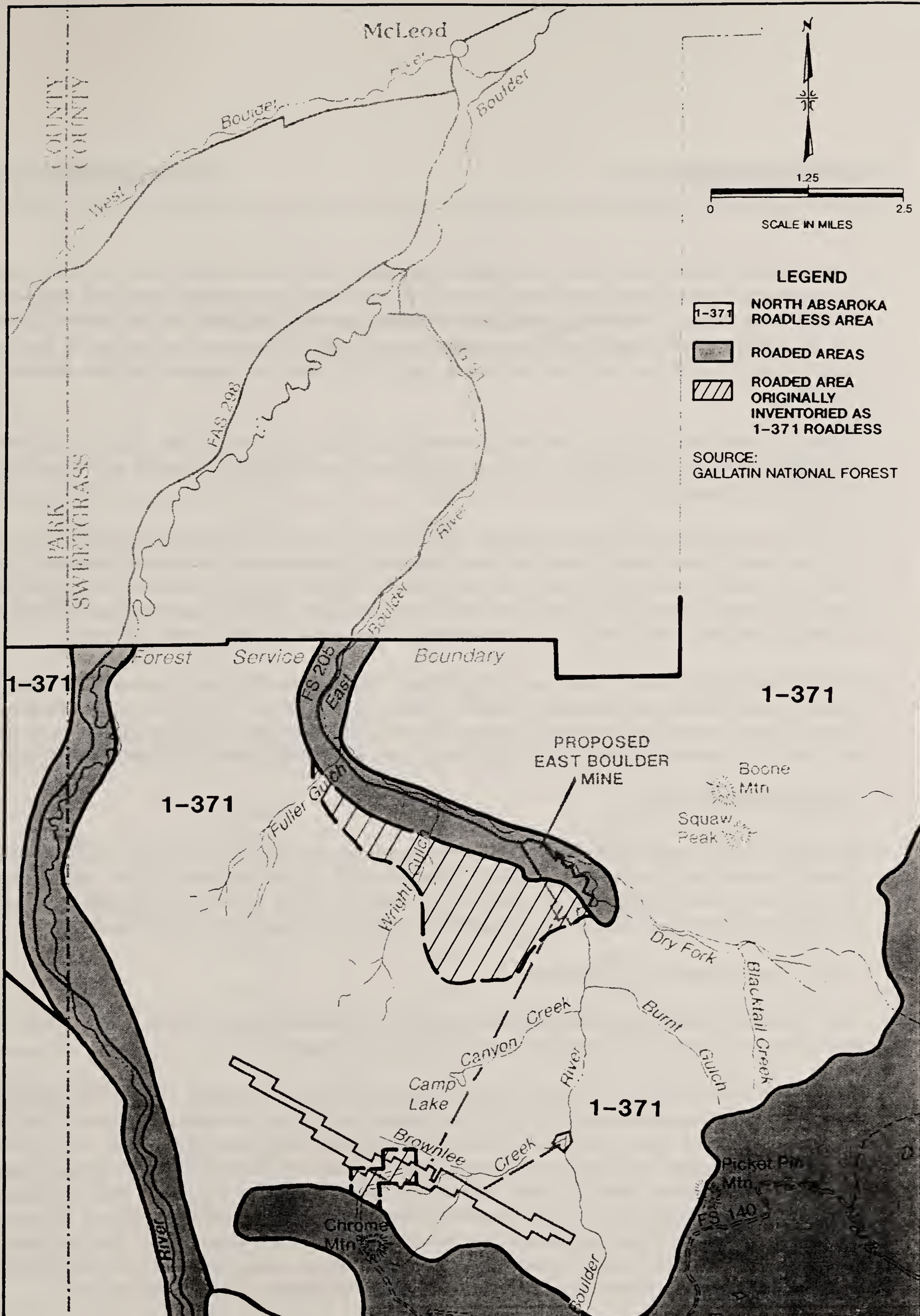
The Absaroka-Beartooth wilderness area is located within a few miles to the south of the Placer Basin permit area, and is easily accessible from the Main Boulder Road. The upper East Boulder River is in a roadless, primitive setting which offers wilderness values of remoteness and solitude (Figure 3.13-2).

The U.S. Forest Service shares responsibility for managing the Natural Bridge and Falls State Monument on the Main Boulder River with the MDFWP. This is a popular site featuring a 100-foot waterfall, several paved walkways, and a footbridge which spans the river. The natural rock bridge collapsed in 1988. The MDFWP also manages the Greycliff Prairie Dog Town State Monument. This protected area contains a prairie dog colony that can be observed from a minor interpretive site. The MDFWP provides fishing access sites throughout the region. There are two access sites on the Main Boulder River, and several access points on the Yellowstone River. The Yellowstone fish hatchery outside of Big Timber is also operated by MDFWP and provides tours of the facility.

In addition to the federal and state recreation facilities, there are many private enterprises. Private campgrounds include the Spring Creek camp and trout ranch, and the KOA camp in Greycliff. Several private church camps are located on the Main Boulder River. Dude/guest ranching has played an important part in the history of Sweet Grass County. There are several outfits still operating in the Big Timber area. They offer guest accommodations, fishing, hunting, hiking, horseback riding, barbecues, and wilderness pack trips, among other activities.

Fishing and hunting are popular dispersed activities for residents and visitors alike. A 1982 survey done by Western Analysis, showed that nearly 60 percent of adults surveyed said they engaged in fishing, while 57 percent hunt. Recent fishing pressure statistics for the Main Boulder and East Boulder Rivers are not available; however, the Main Boulder River is one of the most popular fishing areas close to Big Timber.

There are 22 trails in the Main Boulder River drainage that receive varying degrees of use and maintenance. The Graham Creek trail accesses the East Boulder Plateau and crosses through areas of the Placer Basin permit area which is located on patented mining claims. This trail receives low use. Trails in the East Boulder River drainage include the Green Mountain Trail, the Dry Fork Trail, and the Placer Basin Trail. These trails generally receive low to moderate use, except during hunting season when the Dry Fork Trail receives considerable horse and foot traffic. The wilderness area can be accessed via the Placer Basin Trail; however, major access to the wilderness occurs from trail heads along the Main Boulder River. Outfitting, for both summer pack trips and hunting has seen an increase. Approximately thirteen overnight summer outfitters are permitted to operate in the Main Boulder River and Deer Creek drainages. Eight overnight hunting outfitters and eight day-use hunting outfitters also operate in this area. One overnight hunting outfitter works the East Boulder River drainage; the camp is located in the headwaters of Dry Fork. One overnight summer outfitter's base camp is located within the Absaroka-Beartooth Wilderness in the East Boulder River drainage.




**ROADLESS AREA INVENTORY**

FIGURE 3.13-2

The East Boulder River has a lower level of use. Portions of the Main Boulder River are being evaluated for designation under the Wild and Scenic Rivers Act as a scenic and recreation river. The Main Boulder River drainage is popular with big-game hunters. Within the study area both the East Boulder River and Dry Fork areas receive considerable hunting pressure. Table 3.13-4 shows the number of hunters and harvest figures for elk and mule deer in hunting district 560, which encompasses the East Boulder River drainage.

Winter recreation use in the area includes snowmobiling and cross-country skiing. Most of this activity is in the Main Boulder River drainage, although some use occurs along the unplowed portions of the East Boulder River Road.

The City of Big Timber provides recreational opportunities. The Lions Club Park occupies about 4 acres. There are picnic tables, tennis courts, ballfield, playground equipment and horseshoe pits. Other facilities include a shooting range, basketball courts, and athletic field facilities associated with the public schools. There is an organized baseball program during the spring and early summer, and an organized youth soccer program in the fall (Timko 1991a). The ballfields are at or above capacity during this time.

The Overland Golf Course is 1 mile east of Big Timber. This is a nine-hole public course. The Sweet Grass County fair grounds is approximately 1 mile northwest of Big Timber. This is a 31-acre facility which contains barns, concession and exhibit buildings, a lighted arena, grandstand, and bleachers. It is used for the county fair, rodeos, auctions, community BBQs, cutting horse competition, and the roping club.

## 3.14 SOCIOECONOMICS

The socioeconomic section describes socioeconomic conditions in Sweet Grass County and the town of Big Timber, focusing on those elements likely to be affected by the proposed action and alternatives. Socioeconomic conditions described in this section include the local economy, population, housing, local government facilities, services and fiscal conditions, schools, and local attitudes and opinions.

### 3.14.1 Local Economy and Employment

The economy of Sweet Grass County is based primarily on agriculture and to a lesser extent on tourism and recreation visitor spending at retail and service sector establishments.

Employment and earnings are commonly used measures of an area's economy. The following tables and figures provide information concerning recent employment and earnings conditions in Sweet Grass County. The three sections of Table 3.14-1 display annual Sweet Grass County total employment and employment by sector, employment distribution as a percentage of total employment, and percentage change in employment from 1980 to 1988. The three sections of Table 3.14-2 display annual Sweet Grass County total personal earnings and earnings by sector, annual earnings distributions by sector, and annual change in total and sectoral earnings. All earnings data are presented in adjusted 1990 dollars. Table 3.14-3 presents labor force, employment, and unemployment data for Sweet Grass County for 1980 to 1989 and annual unemployment rates for Sweet Grass County and the State of Montana for the same period.

TABLE 3.13-4

ELK AND DEER HUNTER AND HARVEST
STATISTICS FOR HUNTING DISTRICT 560

Elk

| Year | Hunters Afield | Hunter Days | Total Harvest | Percent Success |
|---|---|---|---|---|
| 1985 | 474 | 2391 | 52 | 11 |
| 1986 | 560 | 2814 | 77 | 14 |
| 1987 | 644 | 3445 | 77 | 12 |
| 1988 | 722 | 3384 | 117 | 16 |
| 1989 | 744 | 3627 | 133 | 18 |

Deer (includes Mule Deer and Whitetail)

| Year | Hunters Afield | Hunter Days | Total Harvest | Percent Success |
|---|---|---|---|---|
| 1985 | 1496 | 4397 | 883 | 59 |
| 1986 | 1015 | 3502 | 697 | 69 |
| 1987 | 1068 | 4320 | 614 | 57 |
| 1988 | 1178 | 3969 | 790 | 67 |
| 1989 | 1290 | 4394 | 965 | 75 |

Source: MDFWP

TABLE 3.14-1
SWEET GRASS COUNTY EMPLOYMENT BY PLACE OF WORK
(1980-1988)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | Average 1980-88 |
|---|---|---|---|---|---|---|---|---|---|---|
| Employment | | | | | | | | | | |
| Total Employment | 1,502 | 1,520 | 1,535 | 1,534 | 1,593 | 1,582 | 1,527 | 1,566 | 1,604 | 1,551 |
| Farm & Ag Service | 462 | 486 | 499 | 507 | 496 | 488 | 491 | 494 | 486 | 490 |
| Mining | 0 | (L)[a] | (L)[a] | 0 | 0 | 0 | 0 | (L)[a] | (L)[a] | 0 |
| Construction | 93 | 75 | 85 | 102 | 112 | 111 | 114 | 111 | 127 | 103 |
| Manufacturing | 28 | 35 | 29 | 27 | 37 | 29 | 18 | 27 | 25 | 28 |
| Trans & Public Util | 25 | 29 | 23 | 22 | 24 | 21 | 20 | 28 | 36 | 25 |
| Wholesale Trade | 25 | 29 | 27 | 38 | 69 | 60 | 21 | 20 | 22 | 35 |
| Retail Trade | 327 | 327 | 300 | 272 | 263 | 260 | 281 | 285 | 284 | 289 |
| F.I.R.E.[b] | 51 | 55 | 64 | 60 | 62 | 64 | 57 | 57 | 59 | 59 |
| Services | 211 | 216 | 247 | 244 | 263 | 291 | 273 | 282 | 289 | 257 |
| Total Government | 280 | 265 | 260 | 262 | 267 | 258 | 252 | 261 | 275 | 264 |
| Federal, Civilian | 25 | 29 | 28 | 29 | 30 | 31 | 24 | 31 | 40 | 30 |
| Military | 19 | 15 | 15 | 17 | 18 | 18 | 19 | 20 | 20 | 18 |
| State and Local | 236 | 221 | 217 | 216 | 219 | 209 | 209 | 210 | 215 | 217 |
| Employment Distribution | | | | | | | | | | |
| Total Employment | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| Farm & Ag Service | 30.76% | 31.97% | 32.51% | 33.05% | 31.14% | 30.85% | 32.15% | 31.55% | 30.30% | 31.59% |
| Mining | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Construction | 6.19% | 4.93% | 5.54% | 6.65% | 7.03% | 7.02% | 7.47% | 7.09% | 7.92% | 6.65% |
| Manufacturing | 1.86% | 2.30% | 1.89% | 1.76% | 2.32% | 1.83% | 1.18% | 1.72% | 1.56% | 1.83% |
| Trans & Public Util | 1.66% | 1.91% | 1.50% | 1.43% | 1.51% | 1.33% | 1.31% | 1.79% | 2.24% | 1.63% |
| Wholesale Trade | 1.66% | 1.91% | 1.76% | 2.48% | 4.33% | 3.79% | 1.38% | 1.28% | 1.37% | 2.22% |
| Retail Trade | 21.77% | 21.51% | 19.54% | 17.73% | 16.51% | 16.43% | 18.40% | 18.20% | 17.71% | 18.65% |
| F.I.R.E. | 3.40% | 3.62% | 4.17% | 3.91% | 3.89% | 4.05% | 3.73% | 3.64% | 3.68% | 3.79% |
| Services | 14.05% | 14.21% | 16.09% | 15.91% | 16.51% | 18.39% | 17.88% | 18.01% | 18.02% | 16.56% |
| Total Government | 18.64% | 17.43% | 16.94% | 17.08% | 16.76% | 16.31% | 16.50% | 16.67% | 17.14% | 17.05% |
| Federal, Civilian | 1.66% | 1.91% | 1.82% | 1.89% | 1.88% | 1.96% | 1.57% | 1.98% | 2.49% | 1.91% |
| Military | 1.26% | 0.99% | 0.98% | 1.11% | 1.13% | 1.14% | 1.24% | 1.28% | 1.25% | 1.15% |
| State and Local | 15.71% | 14.54% | 14.14% | 14.08% | 13.75% | 13.21% | 13.69% | 13.41% | 13.40% | 13.99% |
| Annual Change in Employment | | | | | | | | | | |
| Total Employment | -1.89% | 1.20% | 0.99% | -0.07% | 3.85% | -0.69% | -3.48% | 2.55% | 2.43% | 0.54% |
| Farm & Ag Service | 1.32% | 5.19% | 2.67% | 1.60% | -2.17% | -1.61% | 0.61% | 0.61% | -1.62% | 0.73% |
| Mining | NA | NA | NA | NA | NA | NA | NA | NA | NA | 0.00% |
| Construction | -25.00% | -19.35% | 13.33% | 20.00% | 9.80% | -0.89% | 2.70% | -2.63% | 14.41% | 1.38% |
| Manufacturing | 0.00% | 25.00% | -17.14% | -6.90% | 37.04% | -21.62% | -37.93% | 50.00% | -7.41% | 2.34% |
| Trans & Public Util | -3.85% | 16.00% | -20.69% | -4.35% | 9.09% | -12.50% | -4.76% | 40.00% | 28.57% | 5.28% |
| Wholesale Trade | 8.70% | 16.00% | -6.90% | 40.74% | 81.58% | -13.04% | -65.00% | -4.76% | 10.00% | 7.48% |
| Retail Trade | -2.39% | 0.00% | -8.26% | -9.33% | -3.31% | -1.14% | 8.08% | 1.42% | -0.35% | -1.70% |
| F.I.R.E. | 10.87% | 7.84% | 16.36% | -6.25% | 3.33% | 3.23% | -10.94% | 0.00% | 3.51% | 3.11% |
| Services | -3.65% | 2.37% | 14.35% | -1.21% | 7.79% | 10.65% | -6.19% | 3.30% | 2.48% | 3.32% |
| Total Government | 2.19% | -5.36% | -1.89% | 0.77% | 1.91% | -3.37% | -2.33% | 3.57% | 5.36% | 0.10% |
| Federal, Civilian | -13.79% | 16.00% | -3.45% | 3.57% | 3.45% | 3.33% | -22.58% | 29.17% | 29.03% | 4.97% |
| Military | -5.00% | -21.05% | 0.00% | 13.33% | 5.88% | 0.00% | 5.56% | 5.26% | 0.00% | 0.44% |
| State and Local | 4.89% | -6.36% | -1.81% | -0.46% | 1.39% | -4.57% | 0.00% | 0.48% | 2.38% | -0.45% |

[a] "L" indicates a value less than the BEA reporting minimum.
[b] Financial Institutions, Real Estate
Source: Bureau of Economic Analysis. 1990a.

TABLE 3.14-2
SWEET GRASS COUNTY EARNINGS (1,000's OF 1990 DOLLARS)
(1980-1988)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | Average 1980-88 |
|---|---|---|---|---|---|---|---|---|---|---|
| Earnings | | | | | | | | | | |
| Total Earnings | 25,956 | 23,027 | 18,570 | 17,635 | 18,954 | 18,039 | 19,838 | 21,614 | 21,545 | 20,575 |
| Farm & Ag Service | 9,426 | 7,222 | 3,481 | 3,219 | 3,029 | 2,306 | 5,782 | 7,076 | 6,292 | 5,315 |
| Mining | 219 | 239 | 151 | 112 | 116 | 164 | 60 | 95 | 85 | 138 |
| Construction | 2,205 | 1,711 | 2,064 | 1,722 | 1,946 | 2,110 | 1,819 | 1,777 | 1,995 | 1,928 |
| Manufacturing | 229 | 283 | 213 | 166 | 254 | 178 | (L)[a] | 252 | 147 | 191 |
| Trans & Public Util | 856 | 1,025 | 1,056 | 916 | 1,062 | 948 | 827 | 877 | 1,072 | 960 |
| Wholesale Trade | 576 | 560 | 532 | 673 | 1,320 | 1,115 | 393 | 389 | 401 | 662 |
| Retail Trade | 4,513 | 4,260 | 3,720 | 3,198 | 3,163 | 3,082 | 3,062 | 3,049 | 3,090 | 3,460 |
| F.I.R.E.[b] | 905 | 820 | 668 | 717 | 674 | 648 | 575 | 575 | 585 | 685 |
| Services | 2,714 | 2,694 | 2,599 | 2,720 | 2,952 | 3,212 | 3,188 | 3,248 | 3,388 | 2,968 |
| Total Government | 4,314 | 4,214 | 4,086 | 4,192 | 4,438 | 4,279 | 4,089 | 4,276 | 4,490 | 4,264 |
| Federal, Civilian | 630 | 700 | 659 | 699 | 717 | 764 | 604 | 750 | 1,026 | 728 |
| Military | 96 | 80 | 80 | 98 | 107 | 106 | 118 | 129 | 129 | 105 |
| State and Local | 3,588 | 3,434 | 3,346 | 3,395 | 3,614 | 3,409 | 3,367 | 3,396 | 3,335 | 3,432 |
| Earnings Distribution | | | | | | | | | | |
| Total Earnings | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% | 100.00% |
| Farm & Ag Service | 36.32% | 31.36% | 18.75% | 18.25% | 15.98% | 12.78% | 29.14% | 32.74% | 29.20% | 24.95% |
| Mining | 0.84% | 1.04% | 0.82% | 0.63% | 0.61% | 0.91% | 0.30% | 0.44% | 0.40% | 0.66% |
| Construction | 8.50% | 7.43% | 11.11% | 9.76% | 10.27% | 11.70% | 9.17% | 8.22% | 9.26% | 9.49% |
| Manufacturing | 0.88% | 1.23% | 1.15% | 0.94% | 1.34% | 0.99% | 0.00% | 1.17% | 0.68% | 0.93% |
| Trans & Public Util | 3.30% | 4.45% | 5.69% | 5.20% | 5.60% | 5.25% | 4.17% | 4.06% | 4.98% | 4.74% |
| Wholesale Trade | 2.22% | 2.43% | 2.86% | 3.82% | 6.96% | 6.18% | 1.98% | 1.80% | 1.86% | 3.35% |
| Retail Trade | 17.39% | 18.50% | 20.03% | 18.14% | 16.69% | 17.08% | 15.44% | 14.11% | 14.34% | 16.86% |
| F.I.R.E. | 3.49% | 3.56% | 3.60% | 4.07% | 3.55% | 3.59% | 2.90% | 2.66% | 2.72% | 3.35% |
| Services | 10.46% | 11.70% | 13.99% | 15.43% | 15.57% | 17.80% | 16.07% | 15.03% | 15.73% | 14.64% |
| Total Government | 16.62% | 18.30% | 22.00% | 23.77% | 23.42% | 23.72% | 20.61% | 19.78% | 20.84% | 21.01% |
| Federal, Civilian | 2.43% | 3.04% | 3.55% | 3.96% | 3.78% | 4.23% | 3.04% | 3.47% | 4.76% | 3.59% |
| Military | 0.37% | 0.35% | 0.43% | 0.55% | 0.56% | 0.59% | 0.59% | 0.60% | 0.60% | 0.52% |
| State and Local | 13.83% | 14.91% | 18.02% | 19.25% | 19.07% | 18.90% | 16.97% | 15.71% | 15.48% | 16.90% |
| Annual Change in Earnings | | | | | | | | | | |
| Total Earnings | -12.27% | -11.28% | -19.36% | -5.04% | 7.48% | -4.82% | 9.97% | 8.95% | -0.32% | -2.97% |
| Farm & Ag Service | -14.95% | -23.39% | -51.79% | -7.54% | -5.90% | -23.88% | 150.75% | 22.38% | -11.08% | 3.84% |
| Mining | 91.59% | 9.45% | -36.72% | -26.17% | 3.57% | 41.22% | -63.35% | 58.59% | -10.41% | 7.53% |
| Construction | -29.39% | -22.40% | 20.63% | -16.57% | 13.01% | 8.43% | -13.82% | -2.26% | 12.26% | -3.35% |
| Manufacturing | 8.42% | 23.61% | -24.78% | -22.11% | 53.22% | -29.98% | -100.00% | NA | -41.59% | -14.80% |
| Trans & Public Util | 4.64% | 19.76% | 3.03% | -13.23% | 15.91% | -10.77% | -12.68% | 5.97% | 22.25% | 3.88% |
| Wholesale Trade | 3.65% | -2.74% | -4.96% | 26.56% | 95.99% | -15.53% | -64.75% | -0.96% | 2.93% | 4.46% |
| Retail Trade | -9.47% | -5.59% | -12.68% | -14.02% | -1.09% | -2.59% | -0.63% | -0.42% | 1.35% | -5.02% |
| F.I.R.E. | -25.86% | -9.40% | -18.50% | 7.27% | -6.06% | -3.78% | -11.26% | -0.05% | 1.80% | -7.32% |
| Services | -3.97% | -0.75% | -3.53% | 4.68% | 8.51% | 8.80% | -0.75% | 1.90% | 4.31% | 2.13% |
| Total Government | -7.22% | -2.34% | -3.04% | 2.59% | 5.89% | -3.60% | -4.44% | 4.57% | 5.01% | -0.29% |
| Federal, Civilian | -18.38% | 11.03% | -5.84% | 6.09% | 2.59% | 6.51% | -20.94% | 24.22% | 36.79% | 4.67% |
| Military | NA | -16.61% | 0.91% | 21.34% | 9.64% | -0.79% | 10.67% | 9.73% | -0.14% | 3.86% |
| State and Local | -5.18% | -4.30% | -2.56% | 1.45% | 6.46% | -5.69% | -1.21% | 0.86% | -1.82% | -1.33% |

[a] "L" indicates a value less than the BEA reporting minimum
[b] Financial Institutes, Real Estate

Source: Bureau of Economic Analysis. 1990b.

TABLE 3.14-3

SWEET GRASS COUNTY LABOR FORCE, EMPLOYMENT BY PLACE OF RESIDENCE, UNEMPLOYMENT, AND COUNTY AND STATE UNEMPLOYMENT RATES
(1980-1989)

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| Civilian Labor Force | 1,795 | 1,730 | 1,718 | 1,472 | 1,377 | 1,352 | 1,409 | 1,477 | 1,511 | 1,487 |
| Employment | 1,758 | 1,671 | 1,639 | 1,402 | 1,295 | 1,266 | 1,304 | 1,386 | 1,439 | 1,429 |
| Unemployment | 37 | 59 | 79 | 70 | 82 | 86 | 105 | 91 | 72 | 58 |
| Unemployment Rate | 2.1% | 3.4% | 4.6% | 4.8% | 6.0% | 6.4% | 7.5% | 6.2% | 4.8% | 3.9% |
| State Unemp Rate | 6.1% | 6.9% | 8.6% | 8.8% | 7.4% | 7.7% | 8.1% | 7.4% | 6.8% | 5.9% |

Source: Montana Department of Labor & Industry, Research & Analysis Bureau.

As shown by Table 3.14-1 and Table 3.14-2, agricultural employment, the largest employment sector in the county, remained fairly constant at between 30 and 34 percent of total Sweet Grass County employment and averaged about 32 percent over the eight-year period. Agricultural employment averaged only 25 percent of total earnings, reflecting the lower wages in that sector.

Retail trade, government, and services are the second, third and fourth largest employment sectors in the county, with between 16 and 18 percent of total employment and between 15 and 21 percent of earnings each. The government sector averaged 17 percent of employment and 21 percent of earnings reflecting the relatively higher wages in that sector. There has been very little mining employment in the county in the last several years, and the manufacturing sector averaged less than 2 percent of total employment over the period.

While agricultural employment has remained fairly constant throughout the 1980s, agricultural income has been volatile. Annual change in agricultural earnings ranges from a decrease of about 24 percent in 1985 to an increase of 150 percent in 1986. Agricultural earnings decreased about 33 percent in 1990 dollars over the eight-year period. Retail earnings decreased 31 percent over the period while service sector earnings increased by about 24 percent.

The Sweet Grass County labor force decreased from 1,795 persons in 1980 to 1,487 in 1989, a decrease of 308 or 17 percent over the nine-year period. At the same time, employment decreased by 18 percent and unemployment increased by 36 percent. However, the actual number of unemployed people is small (an average of 58 in 1989). The unemployment rate in Sweet Grass County increased from 2.1 percent in 1980 to 3.9 percent in 1989, after peaking at 7.5 percent in 1986.

Total employment statistics as compiled by the Bureau of Economic Analysis of the U.S. Department of Commerce (BEA) (Table 3.14-1) and Montana Department of Labor (Table 3.14-3) differ in the following manner. BEA employment is a count of full- and part-time jobs in Sweet Grass County. Each job is counted, even if two jobs are held by the same person or the job is held by someone living elsewhere.

Montana Department of Labor and Industry (MDLI) statistics count workers who live in Sweet Grass County. County residents who hold jobs in another county are included in the count, and a resident worker who holds more than one job is counted only once.

MDLI total employment for 1980 was 1,758 while BEA total employment was 1,502, which suggests a significant amount of out-commuting. MDLI employment decreased to 1,439 in 1988 while BEA employment grew to 1,604. This suggests that many Sweet Grass County workers hold more than one job since it does not appear that people are commuting into Sweet Grass County for work.

Many people choose to live in Sweet Grass County even though employment opportunities are limited and the wage scale low compared to other parts of the nation, so it is not uncommon for people to hold more than one job. Also, it is not uncommon in Sweet Grass County for both spouses to work (when they can find work) and for people to barter for goods and services or perform work (firewood cutting, ranch work, arts and crafts, etc.) that might not show up in the standard employment statistics (Siegle 1990).

As of August 1990, there were 2,926 active applicants at the Billings Job Service Center and 776 active applicants at the Livingston Job Service Center. Both job service centers serve counties that lie beyond commuting distance of the proposed action and alternatives. There are no readily available statistics concerning active job applicants who live within commuting distance. Yet these statistics provide an indication of a substantial pool of unemployed workers in south-central Montana.

In addition, there are unemployed and underemployed workers not registered with the Job Service Center (Siegle 1990).

### 3.14.2 Population

Table 3.14-4 is a profile of the population of Sweet Grass County covering the years 1980 through 1990. The profile includes a breakdown of total population by place, gender, age, and race. Note that data are not available for all years for all characteristics.

Total population in Sweet Grass County grew from 1980 to 1981 and then remained stable between 1981 and 1986. Since 1986, population has trended downward. Based on an estimated population of 3,143 in 1990, total Sweet Grass County population has declined a little more than 2 percent since the 1980 decennial census when a total population of 3,216 was recorded. Over the same period, population in Big Timber has declined a little more than 8 percent, while population in the unincorporated portion of the county has grown a little more than 4 percent. As a result, Big Timber's share of total population in Sweet Grass County has declined to about 49 percent in 1990 from about 53 percent in 1980, based on current population estimates.

In terms of gender, the distribution of total population in Sweet Grass County has shifted slightly, with approximately 52 percent of the population male and 48 percent of the population female in 1989, compared to about 51 percent male and 49 percent female in 1980. Over the same period, the population has aged somewhat, as reflected in the rise of the median age from less than 36 in 1980 to a little more than 37 in 1989. In 1980, more than 99 percent of the county population was classified as "white."

TABLE 3.14-4

SWEET GRASS COUNTY POPULATION PROFILE, 1980-1990

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Total Population** | 3,216 | 3,300 | 3,286 | 3,300 | 3,303 | 3,300 | 3,300 | 3,100 | 3,200 | 3,060 | 3,143 |
| **Place** | | | | | | | | | | | |
| Big Timber | 1,690 | 1,734 | 1,767 | 1,775 | 1,718 | 1,720 | 1,720 | 1,616 | 1,680 | 1,590 | 1,550 |
| Unincorporated | 1,526 | 1,566 | 1,519 | 1,525 | 1,585 | 1,580 | 1,580 | 1,484 | 1,520 | 1,470 | 1,593 |
| **Gender** | | | | | | | | | | | |
| Male | 1,653 | — | — | — | — | 1,700 | — | — | — | 1,590 | — |
| Female | 1,563 | — | — | — | — | 1,600 | — | — | — | 1,470 | — |
| **Age** | | | | | | | | | | | |
| <5 yrs | 234 | — | — | — | — | 210 | — | — | — | 180 | — |
| 5-9 yrs | 213 | — | — | — | — | 220 | — | — | — | 210 | — |
| 10-14 yrs | 263 | — | — | — | — | 290 | — | — | — | 240 | — |
| 15-19 yrs | 227 | — | — | — | — | 220 | — | — | — | 240 | — |
| 20-24 yrs | 198 | — | — | — | — | 150 | — | — | — | 120 | — |
| 25-29 yrs | 228 | — | — | — | — | 210 | — | — | — | 130 | — |
| 30-34 yrs | 205 | — | — | — | — | 270 | — | — | — | 250 | — |
| 35-39 yrs | 207 | — | — | — | — | 280 | — | — | — | 290 | — |
| 40-44 yrs | 148 | — | — | — | — | 140 | — | — | — | 210 | — |
| 45-49 yrs | 162 | — | — | — | — | 140 | — | — | — | 140 | — |
| 50-54 yrs | 165 | — | — | — | — | 190 | — | — | — | 160 | — |
| 55-59 yrs | 176 | — | — | — | — | 170 | — | — | — | 160 | — |
| 60-64 yrs | 182 | — | — | — | — | 180 | — | — | — | 150 | — |
| 65-69 yrs | 187 | — | — | — | — | 170 | — | — | — | 140 | — |
| 70-74 yrs | 166 | — | — | — | — | 170 | — | — | — | 150 | — |
| 75+ yrs | 255 | — | — | — | — | 290 | — | — | — | 290 | — |
| Median | 35.88 | — | — | — | — | 36.44 | — | — | — | 37.08 | — |
| **Race** | | | | | | | | | | | |
| White | 3,195 | — | — | — | — | — | — | — | — | — | — |
| Other | 21 | — | — | — | — | — | — | — | — | — | — |

Note: A dash "—" means data is unavailable.

Sources: U.S. Bureau of the Census 1990; Stillwater PGM Resources 1989.

### 3.14.3 Housing

According to preliminary results from the 1990 census, the county has a total of about 1,600 housing units, which is an increase of 16 percent over the 1980 total of 1,374. Of the 1,600, approximately 48-49 percent or 770 are located in Big Timber (Langhus 1990a).

Existing vacant housing is a limited commodity in Sweet Grass County and the city of Big Timber. A January 1989 housing inventory identified 13 available rent units in the Big Timber area and virtually no vacant mobile home park spaces (SPGMR 1989). An August 1990 housing inventory conducted by Planning Information Corporation identified a total of three houses for rent and five vacant mobile home spaces.

In January of 1989, there were 54 housing units for sale in Sweet Grass County (SPGMR 1990); the PIC inventory identified 35 units for sale. It is not known how many of these units are vacant, but it is estimated that most are occupied, and the owners of approximately 60 percent of these homes would remain within the Big Timber area after selling their home, renting or purchasing another home of greater or lesser value. The remaining 40 percent would move from the area creating no new demand for housing (Langhus 1990a).

According to city of Big Timber building permit records, nine single-family residential building permits were granted for dwellings within the city of Big Timber from November of 1981 through October of 1990, an average of one per year. During the same period, two permits for multi-family structures and three permits to move mobile homes onto lots were also granted. Building activity in the unincorporated portions of the county has been slightly greater, with most occurring in the Main Boulder and West Boulder River valleys. Sweet Grass County does not track building activity (Langhus 1990b).

There are approximately 233 vacant building lots located within Big Timber, of which 139 are in areas that contain mixed uses or older, smaller homes and are therefore not likely to attract new residential development. The remaining 94 are desirable, in locations likely to attract residential development. It is also important to note that most of these lots are small and would likely require at least 1½ lots to accommodate a new dwelling.

The city of Big Timber is attempting to promote residential development in several areas adjacent to the current city limits. Approximately 40 acres of land adjacent to the city are under extraterritorial zoning for both single- and multi-family residential use. A conceptual plan suggests build-out could accommodate a total 120 units. Additional land is under extraterritorial zoning for commercial, industrial, and public use.

Several parcels have been placed under interim zoning for residential uses. Interim zoning is temporary until the parcel is developed under Montana statutes. The interim zoning must be renewed in January 1991 and again in January of 1992. Interim zoning of these parcels would expire at the end of 1992 if these parcels are not developed. The city is currently developing annexation and facilities plans for these areas.

A conceptual plan for a parcel of approximately 23 acres east of the city suggests that 117 dwellings could be accommodated. Another parcel of slightly over 100 acres located southwest of the city has yet to be planned (Langhus 1990b).

Big Timber is somewhat limited in its ability to develop additional land without major infrastructure investment. The town is bounded on the east by the Main Boulder River, on the north by the Yellowstone

River and on the south by Interstate 90. Providing access and utility service (sewer and water) across these features would be costly (Langhus 1990b).

One subdivision in the Main Boulder River valley south of Big Timber offers 20-acre parcels for sale. As of January 1989, 12 parcels were available (SPGMR 1989). The Sweet Grass County Growth Policy Plan discourages subdivision in the lower Main Boulder River Planning Area (from Big Timber to Natural Bridge), and discourages major subdivisions and suggests density limits in the upper Main Boulder River Planning Area (from Natural Bridge to the old townsite of Independence) (Sweet Grass County Planning Board 1978).

### 3.14.4 Local Government Facilities and Services

#### 3.14.4.1 Sweet Grass County

Sweet Grass County, general government, a Class 6 county under Montana law, is governed by three part-time county commissioners. They meet regularly on the first Monday, Tuesday, and Wednesday and the third Wednesday of each month, as well as special meetings as needed (Scholten 1990a).

The county has about 120 full-time employees. In addition to the clerk's responsibilities for elections and public records, the budgeting, annual reports, and accounting for the county are performed by the full-time county clerk and one and one-half additional staff. All bookkeeping and records are entered manually. The county does not have computerized databases for any of its operations. This can present a problem on occasion, but manual entry is adequate for the present population.

The main administrative operations of the county are conducted in the Sweet Grass County Court House, built in 1896. All offices in the building, except the courtroom, are crowded and current space is inadequate. An issue of general obligation bonds would be required to fund additions or a new structure. The county currently has remaining debt of $18,000, which will be retired in 1993 and was incurred to build Pioneer Nursing Home.

A district court judge conducts hearings in Sweet Grass County three days a month. At other times the courtroom, the building's only meeting room, is used by justices of the peace and for community meetings (Scholten 1990a).

**Sweet Grass County Sheriff**

The sheriff's office is staffed by the sheriff, an undersheriff, two deputies, and five dispatchers who also do clerical work. The dispatch center routes all 911 emergency calls in the county. The deputies double as jailers while on duty. Eight reserve officers and eight members of the sheriff's posse[2] help with enforcement at special events (SPGMR 1989). When a prisoner is being transported by a uniformed officer, the officer attempts to arrange for a reserve officer to fill in.

[2] Reserve officers receive an amount of training specified in state statute and have authorization to carry a weapon; posse members generally have received fewer hours of training and are not authorized to carry weapons. Reserve officers accompany deputies on duty on Friday and Saturday nights to assist the deputies and to gain law enforcement experience.

The staff works 12 hours each day for five days and then takes three days off duty. This average of 57 hours a week is difficult for the staff but is required in order to have sufficient law enforcement in the county while staying within the existing budget. Two additional deputies are needed now at an approximate cost of $61,000 for salaries, benefits, and vehicle. The addition of two deputies would allow eight-hour shifts (Ames 1990; Mauland 1990).

The sheriff has law enforcement responsibility throughout the county, including the city of Big Timber through a special agreement. The sheriff has agreed to patrol Halfmoon campground, as well as Boulder River Canyon under a $6,500 contract with the U.S. Forest Service (Timko 1991b). The office has an unwritten reciprocal agreement with the Stillwater County Sheriff's office, with whom the deputies train. Search-and-rescue efforts are handled by reserve officers and posse members on a voluntary basis.

The sheriff's offices are in the Sweet Grass County Court House which is unsatisfactory for three reasons. First, the offices are very small, and are crowded with files, desks and records. Second, the jail consists of a single room with four bunks, which a district judge has ruled can be used only as a three-day holding cell. Third, security of the law enforcement personnel and equipment is difficult because of the office's and jail's location within an administrative building. When prisoners are housed in other jails, the county incurs the cost of transportation and $35 per day. A new jail with cells for 10 to 14 prisoners, and with offices for the sheriff's department staff, would cost between $800,000 and $1,000,000. That expense would have to be funded by county general obligation bonds (Ames 1990; Mauland 1990).

Vehicles are leased by the county from the sheriff and his deputies for $335 per month. The county supplies insurance for the vehicles (Ames 1990). Thirty-four and one-half percent of the sheriff's budget is paid by Big Timber; the remaining is funded by the county. These percentages could change if population changes (SPGMR 1989).

The crime rate in Sweet Grass County is well below Montana's average rate, and nearly one-third of the national average as shown below.

| Crimes Per 100,000 Population | |
|---|---|
| National average | 5,995.3 |
| Montana average | 3,811.4 |
| Sweet Grass County | 2,090.5[3] |

The county had a total of 67 crimes reported to the Montana Board of Crime Control in 1989. The county had no homicides, rapes, or robberies, 2 aggravated assaults, 16 burglaries, 1 motor vehicle theft, and 48 incidents of larceny (Liffring 1990).

**Disaster and Emergency Services**

The director of emergency services during a disaster is the Sweet Grass County Sheriff. A half-time deputy director is employed to coordinate disaster planning and emergency response with all local government agencies within the county. The agency maintains equipment for radiological monitoring. The fire district's siren is used to alert citizens to emergencies. No radio station operates near the city of Big Timber which

[3] This rate is computed on the basis of an estimated population of 3,200.

could be used to alert the community, but a channel of the cable television company which serves the area can be used to run a written emergency warning (SPGMR 1989).

**County Road and Bridge Department**

The county maintains 620 miles of road, about one-quarter of which are paved with asphalt. The other three-quarters are covered by an all-weather surface achieved by spreading and rolling a combination of shale or gravel, water, and dirt. This surface, called water-bound Macadam, repels water and resists erosion fairly well under moderate use; unlike paved surfaces, moreover, this surface can be graded when needed, a far less expensive method of maintenance than patching or repaving asphalt. The surface is considered to be adequate for today's low-volume usage. None of the roads receives heavy traffic and some receive as few as 300 trips per year, or an average daily total of less than 1. The city of Big Timber maintains its own streets and structures.

The county maintains 800 drainage structures, bridges, and culverts. Many of the structures are inadequate, and the county plans to replace several in 1991. Two of the structures are failing and 20 are near failure. Other structures are acceptable only because of low volumes of traffic; the superintendent believes that failure of these structures would accelerate under increased volumes, or under infrequent but increased loads. Many structures are load-posted, meaning they cannot accept all legal loads. The condition of the structures, of course, lowers the adequacy of the system. Even if roads are adequate, the system is not adequate when bridges are at the point of failure.

The roads and bridges are maintained by seven full-time employees plus a temporary summer worker. The number of employees is adequate for maintaining the status quo, but is inadequate to allow upgrading the service levels of the roads.

The roads and bridges are maintained as a single, countywide district. All but a few roads, to remote areas or to areas used only in summer, are kept open year-round. Sweet Grass County and GNF have a cooperative agreement to exchange maintenance of roads. Sweet Grass County maintains Big Timber Canyon, and the Forest Service maintains the East Boulder Road from the Elk Creek intersection (Timko 1991b). County road and bridge equipment consists of:

5 motor graders
2 loaders
3 tandem dump trucks
2 single-axle dump trucks
1 asphalt distributor
1 low-boy for transporting equipment
1 dozer caterpillar
1 vibratory drum roller
1 grid roller
1 air compressor and trailer
1 2,000-gallon water truck
1 5,000-gallon water trailer

These pieces of equipment are considered adequate for present road maintenance. The supervisor has no plans for further acquisition or replacement equipment (Drivdahl 1990).

The 1989-90 budget for the county shows road and bridge budgets will receive revenues from 18 and 3.574 mills, respectively, the legal maximum, which yield $133,150. Non-tax revenues increase that total to $254,341 (Tax Levy Requirements Schedule 1989-90).

**Justice Courts**

Two half-time justices of the peace now hold court sessions using the district court room in the court house every day but Thursdays (when the district court judge conducts hearings). These accommodations are considered adequate for the present.

The half-time justices will be replaced with a single full-time justice on January 1, 1991. This new justice will continue the practice of using the office provided for the district court judge, except on Thursdays. These office arrangements are also considered to be adequate (McLees 1990).

**Sweet Grass County Airport**

The airport near Big Timber is adequate for the town, according to the chairman of the airport board. The runway is 4,482 feet long and 75 feet wide and can accommodate a Lear jet. A few privately owned hangars have been erected on land leased from the airport board, and space exists for more.

The board is accruing revenues from a 1.5 mill levy in a reserve account which totals $30,600 and will be used in a year or two for resurfacing the runway. The board does not plan any other additions or improvements to the airport (Todd 1990).

**3.14.4.2 City of Big Timber**

The city of Big Timber has a mayor-council form of government, with the mayor, as chief executive, presiding over a four-member council. City representatives also sit on the city board of adjustment, library and park board and on the city-county police committee, planning board, airport board and board of health.

Big Timber maintains its own streets, operates water and sewage systems, provides garbage collection, owns and operates a landfill, maintains and operates a city park with a baseball field and a swimming pool, and provides majority funding for a city-county library located in the city. Big Timber maintains a city hall with office and shop space and owns a number of vehicles and units of equipment which are used in providing public services.

The city has six full-time employees: city clerk, a city treasurer, two public works employees, one of whom heads up public works and solid waste, and two solid waste employees. There are two part-time employees for the city-county library. Two part-time employees are hired seasonally for the park and pool (Jacobs 1990b; Thomas 1990; SPGMR 1989).

**Big Timber General Government**

Big Timber's mayor and council are elected. The mayor receives $250 a month and council members receive $80 a month. Persons who serve on other boards and commissions generally are volunteer appointees.

The city employs two full-time general government personnel: the city clerk and the city treasurer. Approximately 50 percent of the city clerk's time and about 25 percent of the city treasurer's time are absorbed by activities budgeted through the general fund.

Big Timber city hall is an old auto dealership with about 4,000 square feet. Offices for the city clerk and treasurer are maintained in front. The remainder of the building is used for a public works garage and shop. The treasurer uses the front office which has a customer service window. The city clerk's office, behind the treasurer's office, doubles as the city council meeting room (Jacobs 1990b; Thomas 1990).

The city building is considered "barely adequate now" for the office and shop space it provides. There has been discussion of housing the treasurer and clerk in another location and devoting the present building entirely to public works (Jacobs 1990b).

**Big Timber Law Enforcement**

Big Timber does not maintain its own police department. Instead, the city has a funding and administrative relationship with the Sweet Grass County Sheriff's Office, which in turn provides police protection within the city in exchange for a city contribution of funds over and above property taxes levied by Sweet Grass County. The arrangement operates satisfactorily, and there has been no discussion of changing the system, even with potential mine development in the offing (Jacobs 1990b).

The funding arrangement, which was established many years ago, is intended to divide the sheriff's budget equally between the city and county. The city provides 34.5 percent of the sheriff's budget through a direct payment. That percentage was arrived at after it was determined that city taxpayers pay about 14.5 percent of county taxes. The interlocal agreement on law enforcement, through which the city contributes to the county, is renewed annually (Jacobs 1990b).

Cooperation in administration is maintained through what, though never completely formalized, is in practice a joint city and county department of public safety (Ames 1990). City and county representatives sit on a joint police committee (Jacobs 1990b).

**Big Timber Street Maintenance**

Big Timber has 23.08 miles of city streets; about 99 percent of the mileage is paved. The streets are constructed for low traffic and light duty. Currently, they are "in pretty good shape," reflecting the adequacy, under current conditions, of city staffing and of the funds available for maintenance activity. Funding for street maintenance mainly comes from state-shared gas tax revenues distributed to Big Timber (Jacobs 1990b; Thomas 1990).

Because streets were built for low traffic and light duty, there has been some discussion of whether they will hold up under added wear and tear of a greatly increased population. However, this issue has not been studied formally (Jacobs 1990b; Thomas 1990).

Street maintenance absorbs about 1 full-time equivalent (FTE) of city public works employee time and about 0.24 FTE of city solid waste employee time (Jacobs 1990b). In the summer, the city adds an additional employee, generally assigning the employee to the solid waste department and transferring a solid waste employee to street maintenance.

**Big Timber Water**

Big Timber owns and operates a municipal water supply, treatment, and distribution system which serves within city limits. Potentially developable land west of the town is not currently served by the system (Jacobs 1990b).

Operating and maintaining the water system absorbs about 0.4 FTE of public works and/or solid waste employee time and 0.42 FTE of clerical time, i.e., the city treasurer and clerk (Jacobs 1990b).

The water supply consists of two infiltration galleries in the Main Boulder River drainage. The primary gallery, built in 1934 and refurbished in 1959 and 1965, is located on an island about six miles south of Big Timber. The second infiltration gallery, located at the south end of McLeod Street, consists of a gallery, clear well and pump house with two vertical turbine pumps. Originally built near the turn of the century, new galleries were built for the second infiltration gallery in 1981. The pump system was modified in 1964 (SPGMR 1989).

From the first gallery, water flows by gravity to a chlorinator house containing a manual-control chlorinator. Water from the second gallery is chlorinated by a vacuum chlorinator (also manually controlled) operating in conjunction with the pumps (SPGMR 1989).

A storage tank located just south of the city collects gravity-flow water from the chlorinator below the first infiltration gallery. The steel storage tank has a capacity of 650,000 gallons (SPGMR 1989).

The water system serves 840 taps at present. Distribution lines are mostly 8-inch lines (which replaced original 4- and 6-inch lines). Cross-connections and loops also have been installed. Taps are not metered. The distribution system can provide approximately 2,000 gpm (gallons per minute) fire flow to downtown Big Timber and 1,000 gpm to residential areas (Thomas 1990; SPGMR 1989).

Peak daily output of water is between 2.5 and 3 million gallons. These peaks occur in the summer, due to lawn and garden watering. Low output levels of 450,000 to 475,000 gallons per day occur in the winter. On an annual basis, average system output is about 650,000 to 700,000 gallons per day (Thomas 1990).

Big Timber's water system was designed to serve a population of 2,200, based on constraints imposed by the gravity-flow transmission line and storage tank on the upper gallery and the capacity of the pumps on the lower gallery. The upper galleries produce between 400 and 1,200 gpm, depending on the level of the Main Boulder River, but flows to the storage tank range from 400 to 700 gpm. Pumps at the lower gallery can produce 600 gpm. The average total capacity in summer is 1,300 gpm, a combination of 700 upper and 600 lower (SPGMR 1989).

Other components of the system -- chlorination, supply, and distribution -- are adequate (SPGMR 1989). Leakage does not appear to be a problem in the system, despite the high rate of water output per capita. During a water improvements project conducted in 1980, there was excavation across town in three directions, and no leaks were found at that time. Leaks have not been observed since then, either. However, soils in the area are such that leaks may not surface (Thomas 1990).

Although the nominal capacity of the system is 2,200 persons, that specification is based on "normal" usage patterns which apparently do not prevail in Big Timber. Taps are not metered, billings are at fixed quarterly

rates, and irrigation demand is extremely high in the summer (Jacobs 1990b; SPGMR 1989). To curb usage and ensure that the system storage tank can be refilled overnight, the city imposes watering restrictions. The city also charges a once-a-year irrigation fee of $40.51 for lawn watering. The charge is added to the quarterly billing for July, August, and September service (Bjorndal 1990; Jacobs 1990b; SPGMR 1989).

Because the water system currently cannot supply enough water to allow unrestricted domestic irrigation in the summer, Big Timber has considered improvements to increase capacity. One proposed approach is installing a new and larger transmission line from the upper gallery. Apart from its size, the transmission line also is "deteriorated," according to SPGMR (1990). An alternative to replacing the transmission line is increasing the size of the pumps on the lower gallery (SPGMR 1989).

Apparently there is little local support for policies or system changes which restrain demand. The current water restrictions are unpopular. Metering also may be an unacceptable alternative to the current population. Despite their impact on the water system, accustomed lawn watering practices are considered an entitlement by most of the existing residents of Big Timber, according to Jacobs (1990b).

**Big Timber Sewer**

Big Timber operates a sewage collection system and an 18-acre lagoon. Almost all the areas served are within the existing city limits. An exception is the collection line and lift station now serving an area west of Big Timber which is described in more detail below (Jacobs 1990b).

Operating and maintaining the sewer system absorbs about 0.3 FTE of public works and/or solid waste employee time and 0.42 FTE of clerical time, i.e., the city treasurer and clerk. Big Timber's existing sewage collection system is said to be in good condition. An improvements survey conducted in 1978 found no evidence of significant infiltration (Jacobs 1990b).

Lift stations owned by the city of Big Timber serve the northern portion of Big Timber along the Yellowstone River and the Lowry Subdivision on the southeast edge of the city. A privately owned sewer line and lift station serves the area which includes the Country Pride Restaurant (SPGMR 1989).

The lagoon is divided into two cells. An aeration system is installed in the larger, 11-acre cell to increase capacity and meet secondary treatment standards. The 7-acre cell, which is not aerated, currently is used as an emergency pond (Jacobs 1990b).

The design capacity of the system is 523,000 gpd and an implied population of 2,050. System flows average 434,000 gpd (gallons per day), with a peak flow of 448,000 gpd (SPGMR 1989). However, the city is "just getting by" with the current sewage lagoon, according to Thomas (1990). Although the system is still meeting state standards, the aeration system, consisting of plastic channeling curtains and aerators, has deteriorated sooner than expected and needs to be upgraded, just to handle the existing population (Jacobs 1990b; Thomas 1990).

To meet existing needs, there has been discussion of resealing the emergency pond to make it more usable. This would allow more holding time and increase the capacity of the treatment unit. To grow beyond the current population would require development of possibly another treatment cell (Jacobs 1990b; Thomas 1990).

In addition to Big Timber's service area within city limits, there is a private lift station and line which serves the area containing the Country Pride Restaurant, a museum, and a cabin outside the city limits between the city and the west interstate interchange. The private sewer line and lift station were installed by the owners of the restaurant and the cabin, and the city agreed to accept the sewage unless it overloads the treatment system (Jacobs 1990b).

Although the area served is within the general vicinity of land viewed as potentially developable to serve growth in Big Timber, city officials feel the existing line and lift station would have to be upgraded to allow for anticipated levels of growth associated with the proposed action. One configuration which has been discussed is establishing a new collecting point and servicing it with a lift station and trunk line which would bypass existing facilities, but touch the lower edge of Big Timber (another potentially developable area), before emptying into the sewage treatment lagoon (Jacobs 1990b).

**Big Timber Solid Waste**

A Class II sanitary landfill operated by the city of Big Timber is the only approved landfill in Sweet Grass County. However, the old landfill is virtually full, and the city has opened a new site (SPGMR 1989; Jacobs 1990b).

The city provides garbage collection to residential and commercial customers in Big Timber, using two packer trucks. Residential pickups are weekly; commercial service is more frequent, if needed. Volume is approximately 2,000 tons of garbage a year (SPGMR 1989).

Operating and maintaining the solid waste department absorbs about 0.4 FTE of public works employee time, 1.7 FTE of solid waste employee time and 0.4 FTE of clerical time, i.e., the city treasurer and clerk (Jacobs 1990b).

The city has acquired an 89-acre site for a new landfill four miles north of Big Timber. The application for the site has been approved by the state. However, the state Department of Health was writing up the final impact statement and a public hearing was pending at the time data were being gathered for this report. Big Timber officials expected the landfill to be licensed by January 1, 1991, and planned to begin construction as soon as the permit is issued (Jacobs 1990b).

With approximately 30 acres available for pit space, the new site was projected to have a useful life of 70 years for the current population and volume of garbage. The estimate was reduced from 80 years because the possibility of seepage was identified which eliminated a potential pit area (Jacobs 1990b).

To fund the project, Big Timber is preparing to issue $450,000 in revenue bonds. The projected costs include the acquisition of a used track loader to replace the existing rubber-tired loader and $90,000 to close the existing landfill. According to preliminary studies, the bonds were expected to cost between 6 and 7 percent for a 20-year life, translating into an estimated $40,000 to $50,000 a year in debt service costs (Jacobs 1990b). In anticipation of the bond issue, Big Timber raised fees for the collection and disposal of solid waste by about 72 percent, effective in fiscal 1990-91 (Bjorndal 1990).

Assuming current population levels and volume of garbage, operating the new landfill is not expected to require additional personnel. An issue which has not been resolved is how to service landfill equipment located at the remote site (Thomas 1990).

**Big Timber Parks and Recreation**

Big Timber City Park, totaling four acres, has a swimming pool and wading pool, two public rest rooms, two tennis courts, a baseball field, a basketball court, a horseshoe pitching area, a picnic shelter, and playground equipment (Jacobs 1990b; SPGMR 1989). Seasonal employees hired to maintain summer recreation programs are a groundskeeper and three pool attendants (Jacobs 1990b; Thomas 1990; SPGMR 1989). Major maintenance on the park and pool is performed by public works personnel (Thomas 1990).

A new baseball field is in place on land owned by the Sweet Grass County High School District. The fields were developed using funds raised by a private association and city and county contributions of labor and equipment. The field is maintained by the high school. The school may make use of the athletic fields at this site in the future. However, increased use by the high school is not expected to impact the city baseball programs because school use is in the fall and spring and city use is in the summer (Jacobs 1990b).

With the addition of the new baseball field, baseball facilities are perceived as adequate for the foreseeable future, even assuming potential population growth due to the proposed action. Organized baseball programs are now run by a volunteer association and funded by the American Legion and individual donations (Jacobs 1990b; Thomas 1990). Big Timber has a volunteer soccer association and needs a soccer field (Timko 1991b).

The park facilities are seen as crowded. The city pool has recently been condemned and closed.

**Big Timber Personnel, Vehicles and Equipment**

Efficient operations in Big Timber have depended on versatility. None of the city's physical or human resources are dedicated solely to the performance of a single function. Table 3.14-5 presents the personnel employed by the city of Big Timber and the allocation of their time among various city services. Table 3.14-6 presents the vehicles and equipment owned and operated by the city, their condition, and the allocation of their costs among city departments.

TABLE 3.14-5

PERSONNEL EMPLOYED AND ALLOCATION OF TIME BY FUND
CITY OF BIG TIMBER

| Function | Employees | Allocation of Time by Fund[a] | | | |
|---|---|---|---|---|---|
| | | General Fund | Water | Sewer | Solid Waste |
| Public Works | 2 | 50% | 18% | 14% | 18% |
| Solid Waste[b] | 1 | 21% | 3% | 3% | 73% |
| | 1 | 3% | 1% | | 96% |
| Clerk | 1 | 50% | 16.7% | 16.7% | 16.7% |
| Treasurer | 1 | 25% | 25% | 25% | 25% |

[a] Budgeted allocations based on past history and anticipated workload in fiscal year 1990-91.
[b] An additional solid waste employee is hired in the summer allowing one year-round solid waste employee to work on street maintenance and other public works projects.

Source: Jacobs 1990b.

TABLE 3.14-6

INVENTORY OF VEHICLES AND EQUIPMENT WITH ALLOCATION OF COSTS BY FUND
CITY OF BIG TIMBER

| Date | Item | Condition | Allocation of Time by Fund: General Fund | Water | Sewer | Solid Waste |
|---|---|---|---|---|---|---|
| | | Vehicles | | | | |
| 1973 | 1/2-ton Ford pickup | Poor | 40% | 40% | 10% | 10% |
| 1967 | 1/2-ton Ford pickup | Poor | 30% | 20% | 40% | 10% |
| 1985 | 1/2-ton Ford pickup | Good | 40% | 40% | 15% | 5% |
| 1971 | GMC garbage packer | Poor | | | | 100% |
| 1973 | GMC garbage packer | Poor | | | | 100% |
| 1962 | Ford F700 dump truck | Poor | 50% | 10% | 10% | 30% |
| 1972 | IH dump truck | Fair | 70% | 10% | 10% | 10% |
| 1988 | Ford F700 dump truck | Good | 50% | 25% | 25% | |
| | | Equipment | | | | |
| 1979 | IH payloader | Fair | 20% | 10% | 10% | 60% |
| 1952 | Ford 8N tractor | Fair | 25% | 25% | 25% | 25% |
| 1972 | Caterpillar motor grader | Fair | 70% | 10% | 10% | 10% |
| 1977 | Elgin street sweeper | Poor | 100% | | | |
| 1983 | Ford backhoe | Good | 30% | 30% | 30% | 10% |
| 1948 | Buffalo Springfield roller | Poor | 100% | | | |
| 1969 | IH TD20B crawler | Poor | | | | 100% |
| | Gorman Rup portable pump | Good | 25% | 50% | 25% | |
| 1975 | Onan generator | Good | 20% | 15% | 50% | 15% |
| | Miller Internation disc | Fair | | | | 100% |
| 1981 | Miltiquip 6" portable pump | Good | 25% | 50% | 25% | |
| 1984 | Plate whacker (compactor) | Good | 100% | | | |
| 1940 | American Standard tar pot | Fair | 100% | | | |
| 1975 | Rockwell Int. pipe rdder | Poor | 20% | | 80% | |

Source: Jacobs 1990b; Thomas 1990.

**Carnegie Public Library**

The library is open to the public 26 hours a week. The 1913 Carnegie building has not been remodeled or expanded since its erection, and presently is at capacity--in fact, crowded. It has three reading areas, including one for periodicals in the basement which is also used by the Big Timber Women's Club. The reading areas, however, are crowded by book shelves. The librarian says that discussions concerning additions have taken place, but that sufficient money is not available. A building fund has been established which totals about $15,000 today. No capital has been added to the fund for eight or ten years, but the fund does grow from year to year from accrued interest.

The library is staffed by three part-time employees: the librarian and an assistant who each work 26 hours a week, and a second assistant funded from non-budget sources, who works 16 hours a week. These hours are adequate on the whole, but the librarian would like to be able to offer early morning hours to accommodate school children who arrive and leave by bus and today have no opportunity to use the library. The library has 22,000 volumes and 60 periodicals. These numbers are adequate for the present population, according to the librarian, but she would like to be able to offer some audio-visual materials which she has been unable to do because of space limitations.

The $32,000 annual library budget includes all salaries and book acquisition. The budget is funded 60 percent from the city and 40 percent from the county; however, the county has not always been able to pay its share and in those instances the city makes up the difference. Occasionally the library is the recipient of a grant from the coal severance fund which is in addition to the budget. The library has no debt (Goosey 1990).

A board of trustees governs the operation of the library. Four of its members are appointed by the city council and one is appointed by the county commissioners (SPGMR 1989).

**3.14.4.3 <u>Other Facilities and Services</u>**

**<u>Big Timber and Sweet Grass County Fire Protection</u>**

Although distinct on paper, in fact the Big Timber Fire Department and the Sweet Grass County Fire District are operated as one agency under a single chief with shared resources. For convenience in this document we will refer to the two groups as the fire district.

The fire district has a main station in Big Timber and substations in Melville and Reed Point (known as the Bridger Creek fire crew). The volunteers and equipment from the substations are used to fight wild fires rather than structural fires. The Big Timber station has 40 volunteers; Melville and Reed Point each has between 15 and 20 volunteers. These numbers of volunteers are adequate for present needs. The volunteers include three emergency medical technicians. All volunteers receive 60 to 70 hours of training each year. None receives any salary, although the fire chief has use of the district's pickup truck.

The fire district has mutual assistance agreements with Park County, a small portion of Stillwater County, the U.S. Forest Service, and DSL. Equipment for the Big Timber station consists of:

1985 1,000-gpm pumper with 1,000-gallon tank
1957 pumper with 750-gpm capacity
1966 Ford with two pumpers of 250-gpm and 750-gpm capacity and a 750-gallon tank
1969 International 4-wheel drive vehicle with 500-gpm pumpers and a 1,000-gallon tank
1958 Army 6 x 6, with 250-gpm pumper and 1,000-gallon tank
1963 Jeep with 250-gpm pumper and a 250-gallon tank[4]
1968 International tanker with 2,500-gallon capacity
1990 Ford 4 x 4 pickup truck
1970 4 x 4 Suburban
1976 Ford 600, 4-wheel drive with 500-gallon capacity and 250 gpm pump
1979 Ford, 3,500-gallon capacity
A Dodge Army surplus 3/4 ton pumper with 250-gallon tank

The Reed Point fire hall has an Army surplus 6 x 6 pumper with 250-gpm capacity and a 1,000-gallon tank and a 1-ton Jeep with a 250-gpm pumper and 250-gallon tank[4]. The Melville fire hall has two Jeeps both with 250-gpm pumpers and 250-gallon tanks.[4]

The fire district has no debt. A five-year replacement plan is in place which is intended to replace one vehicle every five years. Because the fire district has 15 pieces of equipment, this replacement schedule means that it will take 75 years for all equipment to be replaced. The reserve fund that will pay for new equipment is funded by the city of Big Timber, Sweet Grass County, and by donations and fund-raisers.

The district's equipment is housed in four structures. The fire halls in Melville and Reed Point are adequate; the fire hall in Big Timber is considered by the chief to be very inadequate. The building, erected in 1907, is a three-bay structure that is far too small to house the seven pieces of district equipment stored there. Two additional vehicles are maintained in a garage in Big Timber owned by the American Legion (Lowry 1990).

### Health and Hospital

The hospital in Sweet Grass County is operated by a nonprofit corporation called Sweet Grass Community Hospital, Inc., which is not affiliated with a national hospital corporation. The corporation leases the 1949 building from the county for $1 per year. The county does not fund the operations of the hospital, nor would it share in any revenues above costs.

[4] These vehicles are used by the district and owned by the Montana Department of State Lands.

The hospital has an average daily patient load of 2.0, down from last year's 2.5. That translates into an occupancy rate of about 10 percent. Beds not in use by medical or surgical patients can be used by residents of the Pioneer Nursing Home, a facility which is at capacity. The use of the hospital for nursing home residents is not entirely satisfactory because the hospital was not designed for that use and because the nursing home is a physically separate facility. That use, however, is considered to be superior to having the beds lie empty while potential nursing home residents are kept on a waiting list.

Approximately 28 percent of Sweet Grass County residents seek health care at Sweet Grass Community Hospital. Thirty-five percent travel to one of Billings' two hospitals, 17 percent to Livingston, 5 percent to Bozeman, 3 percent to Columbus and the remaining 12 percent to other unspecified hospitals.

The services the hospital offers are either in-house, that is, available full time, or brought in as needed from other facilities. Full-time services are:

Pharmacy
Laboratory
General Surgery
X-ray
Emergency
Cardiac rehabilitation
Hospice
Chemotherapy
Home Health Care
Physical Therapy

Services which are brought to Big Timber include ophthalmology, orthopedic medicine, cardiology, mammography and ultrasound.

The facility is considered to be inadequate by the new hospital administrator who arrived in the summer of 1990. Two badly needed improvements, a new roof and a renovated heating system, were completed in the fall of 1990. According to the hospital administrator, the 1967 life safety code standards are not being met, but the hospital may soon be surveyed against the newer standards which will not be met. He believes that a new hospital will have to be built for the standards to be met. The hospital board has several options from which to choose to fund a new hospital, including the formation of a hospital district with districtwide taxation. The new facility would also have 10 hospital beds, would cost about $2.0 million, and would be combined with a new nursing home in order to achieve some efficiencies in administration, nursing care, and food service.

Seventeen full-time employees, plus about 20 part-time workers, staff the hospital. This level of staffing is believed to be sufficient for the present patient load and fewer would be required to operate the new facility as well. One physician and one physician's assistant live in Big Timber and a second physician is being recruited currently.

An endowment fund to support the hospital was begun in 1988. The fund currently has $400,000 in pledges and income. In three years the fund is expected to generate about $50,000 of interest income annually, which will be used to supplement patient fees for hospital operations.

About 70 percent of all patients are Medicare patients, leaving the hospital with uncovered costs. The hospital's annual budget was $900,000 in 1991, and the corporation had a debt of $167,000 (Quint Ehley, Hospital Administrator, 1992).

Sweet Grass Community Clinic

The Sweet Grass Community Hospital, Inc., has recently entered into an agreement with Sweet Grass County to lease the clinic for $1 per year. The corporation in turn leases the clinic, which is attached to the hospital, to the community's dentist and physician (Tucker 1990). Outpatient medical and dental services are offered to the public in separate facilities in the clinic. The dental offices include four dental operating rooms, an office, a laboratory with X-ray equipment and darkroom. The medical offices were built to accommodate two physicians and are adequate for the community at present. They have five examination rooms, a room for minor surgery, offices, an X-ray room with darkroom, and a small laboratory (SPGMR 1989).

Pioneer Nursing Home

In 1965 Sweet Grass County built Pioneer Nursing Home using proceeds from county bonds and federal funds. The home provides long-term care to county residents in 48 licensed beds. The home is funded from fees and Medicaid, but receives no Medicare monies. The facility is at capacity and uses available beds at the hospital to care for additional residents. This situation is unsatisfactory because the two buildings are separate and the hospital was not built to house long-term residents. The capacity of the home is inadequate for the present population of Sweet Grass County (Tucker 1990). About 93 percent of the patient population is 75 years old or older, and most are Sweet Grass County residents (SPGMR 1989).

Emergency Medical Services

Emergency medical services are provided by the Sweet Grass County Ambulance Service as a nonprofit agency. Calls are routed to the service by a countywide 911 service dispatched by the sheriff's office. The ambulance service has 15 registered emergency medical technicians (EMTs). About half of the EMTs are on call 12 hours a day for seven days and then off duty for seven days. These EMTs are paid $75 per month. The other half of the EMTs are called as needed and are paid a small fee by the call. All EMTs receive in-service training twice a month. The present number of EMTs is adequate for the community.

The agency's vehicles consist of a 1984 ambulance, a 1976 Ford modular ambulance, and a 1985 4 x 4 suburban. These vehicles are adequate in number and size, but are out of date in their fittings and equipment. The 1984 ambulance has 135,000 miles on the odometer and will need replacement within five years.

About 70 percent of the agency's $40,000, 1990 budget is expected to come from fees and the rest will come from the county's general fund.

Fixed-wing aircraft and helicopters from Billings' two hospitals provide air ambulance service to the hospitals 76 air-miles away (Hanson 1990; SPGMR 1989).

Welfare and Family Services

In Montana, welfare and family services are administered by the county, although they are state programs. Funding for services comes from different sources and in different amounts according to the service provided (see below). Staff in Sweet Grass County is paid by the state of Montana and splits its time between more than one county. Stated in simplified terms, welfare programs are cash grants to eligible clients; family services for eligible clients are composed of various kinds of assistance, rather than cash. The welfare office and the family service office operate independently, though with full knowledge of each other, and often serve the same clients. We will discuss welfare programs first.

**Welfare Programs and Their Funding**

| | Budget Sources in Percent | | | | Average Monthly | Total FY 1990 |
|---|---|---|---|---|---|---|
| Program | Fed | State | Cnty | Other | Cases | Payments |
| AFDC | 65% | 29% | 6% | 0% | 12.7 | $ 47,900 |
| Medical Asst | 65% | 35% | 0% | 0% | 62.0 | $364,400 |
| Food Stamps | 100% | 0% | 0% | 0% | 35.0 | $ 69,900 |
| Transient Assist. | 0% | [5] | • | 0% | N/A | N/A |
| Food Bank | 0% | 0% | 0% | 100% | N/A | N/A |
| Christmas Gifts | 0% | 0% | 0% | 100% | N/A | N/A |

(Goehring 1990; Montana Department of Social and Rehabilitation Services 1990)

A director of welfare dedicates 30 percent of her time to Sweet Grass County; she is assisted by a part-time eligibility aide and a part-time eligibility technician who spend 65 percent of their time on Sweet Grass County duties. The department has requested that the eligibility aide who works three-quarters time become a full-time employee, but does not expect this request to be granted.

The number of clients changes from month to month. In September 1990, 36 families (103 recipients) received food stamps; 11 families received $3,311 in AFDC; 65 individuals received $26,691 in medical assistance; and 19 transients were assisted (Goehring 1990).

The Montana Department of Family Services conducts its work in the county through the efforts of a half-time community social worker and a half-time human services aide. The social worker divides her time between two counties and is on-call 24 hours a day. The services provided by the department include:

Foster care for children, disabled adults, and adults aged 60 and over
Protective services for the same group as above
Referrals for parents relinquishing children for adoption
Adoptions of children in the custody of the department
Licensing of foster care homes, daycare centers, and homes for developmentally disabled adults
Licensing group homes, residential treatment centers, and after-care services following release from juvenile detention centers

[5] Funding comes from the state and county in percentages which vary with the origin and destination of the client.

These services receive funding from the federal, state, and county governments in ratios which differ depending upon family income and whether the family members are of Native American heritage. Services are mandated of the department by law, without differentiation for income or heritage, but the funding of those services is based on those differences.

Employees believe that community needs are not now being met with current staff and funding. Foster care homes, in particular, are critically needed.

State law has frozen the amount a county can spend on foster care at the levels each county spent in 1987. In Sweet Grass County, that amount is $600. This figure does not change with increases or decreases in population, county valuation, cost of living, or numbers of persons requiring foster care. Sweet Grass County's foster care load has risen from two in 1987 to ten in 1989. Those who accept foster care children receive $9.66 per day for children from birth through 12 years and $12.10 per day for those 13 and older. Therefore, Sweet Grass County's foster care budget can fund those ten children for only about six days each. The state is expected to fund the difference between the 1987 foster care budget and today's needs, but the state is unable to. The counties and the state are at odds over this issue (Crawford 1990; Harvey 1990).

Chemical Dependency Program

About 50 Sweet Grass County clients were served by the county chemical dependency program in 1989. Service was provided by a full-time director-counselor and a part-time secretary, his wife. Together they operate the Big Timber satellite office of the Rim Rock Foundation of Billings. The county pays the foundation $1,900 per month to operate the program. The county raises that amount through several state taxes (motor vehicle tax, interest on delinquent taxes, liquor tax apportionment and block grants), $2,500 to $3,500 annually from the city; and a county mill levy (Ronneberg 1990). The program also receives fees from clients, based on family income and family size (SPGMR 1989).

The director spends about 80 percent of his time in Big Timber, and about 20 percent counseling Sweet Grass County clients who are under his care in Billings. The director believes that the program is adequately fulfilling the community's needs (Fuller 1990).

Mental Health Programs

Mental health programs are overseen by the South Central Montana Regional Mental Health Center. The center is funded 45 percent from the state, 10 percent from the county, and the remainder from client fees, based on ability to pay. Because the principal funding for the program comes from governmental agencies which budget on an annual basis, it would be difficult for the program to adjust quickly to increased demand for services. One social worker spends one day a week with clients in Big Timber. The business manager believes that the program is adequate for present community needs (Wulfekuhle 1990).

Seniors' Programs

Big Timber is served by an active program for senior citizens which includes meals-on-wheels service, congregate meals, low-income subsidized housing, limited bus transportation, and social activities. About 85 to 90 senior citizens in Big Timber participate in various parts of the program.

Meals on wheels are served at noon on Mondays, Wednesdays, and Fridays. Twenty-four volunteers delivered approximately 1,000 meals in 1989, for an average of about 6 or 7 clients per day.

Congregate meals are served at noon four days a week at the senior center, Hospitality House. The dining room at Hospitality House can seat 95 persons at a time and 56 is the average attendance. Peak attendance is usually 75 to 80 and that generally occurs on Wednesdays. Both congregate meals and meals on wheels are prepared at the center. The director of Hospitality House believes that the meals' quality improved when food preparation was moved from the hospital to the center and food began to be prepared from scratch.

Social activities also occur at Hospitality House, which is open from 7:00 am to 5:00 pm four days a week, and from 9:30 am to 5:00 pm on Thursdays. People come to play cards and bingo, to visit with one another, and to share their meals.

The center owns a 12-passenger bus that is used to transport senior citizens to and from the center. Ten or 12 people take advantage of the service each day it is offered. In addition, senior citizens can use the bus two days each month for travel to appointments in Bozeman and in Billings. The center will receive a new bus with a wheelchair lift in November of 1990.

A donation for the meals is suggested: $1.50 for congregate meals and $1.75 for meals on wheels. Additional funding comes from the federal level through a regional, 11-county administrative level. One full-time and two part-time employees operate the center and meal operations. The current budget and staff are considered by the director to be adequately meeting the community's needs. She is concerned that the federal budget cuts being discussed in the news could lead to a greatly reduced budget in 1991. She believes that any reduction in the program will leave some community needs unmet.

About 40 units for low-income seniors are available in Big Timber in two groups of apartments. More units are available than are demanded; the extra units have been rented to non-senior low-income persons. The director of Hospitality House believes that the low-income units do not have a waiting list of persons desiring housing, and are adequately meeting the needs of the elderly (Moor 1990).

### Daycare Programs

Big Timber has two daycare providers licensed by the Montana Department of Family Services. Together those two providers care for 16 children in Big Timber. Department employees consider the number to be completely inadequate to meet the community's needs (Goehring 1990; Crawford 1990; Harvey 1990).

### Prevailing Wages in Local Government

County elected officials' salaries are set by state statute. All other county employees receive compensation set by the county commissioners. By statute, deputy sheriffs are paid 90 percent of the salary of the sheriff's salary of $21,500. However, several years ago the city of Big Timber and the county formed a joint department of public safety, though it was never completely formalized. This arrangement permits the department to pay above the statutory salaries, and to schedule the deputies for hours in excess of 40 per week (Mauland 1990). Below is a summary of wage ranges.

Pioneer Nursing Home: Wages for full-time professional employees range from $27,500 for the administrator to about $22,000 for registered nurses and $13,500 for the dietician and the licensed practical nurses. Nonprofessional staff earn from about $10,000 for laundry and housekeeping workers to $12,000 for maintenance workers.

Other county employees: Salaries range from $20,300 for the county road supervisor to $7,500 for custodial workers. Some employees (dispatchers, ambulance drivers, deputy clerk of the court, one secretary) are paid by the hour or month for part-time work, or for full-time seasonal work. The hourly rate ranges from $4.73 to $6.15 (Sweet Grass County, Montana, Salary Resolution 1990-91).

Big Timber employee salaries are set by the council. The employees receive a 2 percent longevity pay raise each year and a cost-of-living raise that is negotiated annually. The city's four full-time employees are the city clerk, the finance officer and two members of the plant crew (handling solid waste, street repairs, water-system and sewer-plant work). These four employees earn wages that range from $1,350 to $1,700 per month. Full-time temporary summer help at the park and additional members of the outside crew earn from $5.00 to $6.25 per hour (Jacobs 1990a).

#### 3.14.4.4 Public Schools

Sweet Grass County contains five elementary schools: Big Timber Grade School and four rural elementary school districts. The four rural elementary schools in Sweet Grass County are McLeod, Melville, Grey Cliff, and Bridge. Elementary students on the eastern and western borders of Sweet Grass County are served by joint school districts with Stillwater and Park counties, respectively (SPGMR 1989). Among rural elementary schools, only McLeod Elementary School, District 29, is likely to experience significant additional enrollment due to the proposed action.

County students in grades 9 through 12 are served by Sweet Grass County High School in Big Timber.

Big Timber Grade School, District 1, and Sweet Grass County High School are each headed up by a superintendent. Chief administrative functions for McLeod Elementary School are performed by the Sweet Grass County Superintendent of Schools. The county superintendent also formally establishes property tax levies and approves budgets for all schools in the county (SPGMR 1989).

Enrollment in all county schools for the 1990-91 school year was 390 students in grades K through 8 and 196 students in grades 9 through 12. Total school enrollment by grade in Sweet Grass County for the past ten years is presented in Table 3.14-7. Countywide enrollment levels have tended to decline over the ten-year period, particularly at the grade-school level. Maximum elementary enrollment was 446, 24 students greater than the ten-year average, and minimum enrollment was 32 less (plus 6 percent and minus 8 percent). Maximum secondary enrollment was 198, 8 students greater than the average, and minimum was 7 less (plus 4 percent and minus 4 percent) (SPGMR 1989; Schott 1990; Webb 1990b).

The Montana Board of Public Education has adopted maximum student-teacher ratios for accredited schools. New standards will go into effect in 1992. Table 3.14-8 presents the current and new standards.

Although the Montana Board of Public Education sets maximum student teacher ratios which may not be exceeded, local school trustees may set more stringent standards which they consider more beneficial to the quality of education in their district. While low student-teacher ratios may sometimes be a result of

declining school enrollment or small classrooms, low student-teacher ratios may also be the result of intentional policy decisions made by the trustees and upheld by the voters of the district through their support of the mill levies necessary to maintain a district's more stringent standards.

**Big Timber Grade School, District 1**

Big Timber Grade School serves kindergarten through 8th grade students from Big Timber and the central third of Sweet Grass County. Enrollment for the 1990-91 school year was 328 students. Table 3.14-9 shows enrollment by grade for school years 1984-85 to the present. These data indicate that enrollments have tended to decline over the past seven years. Peak enrollment during the period was 382 students in 1985-86.

The Big Timber Grade School was built in 1953 and added to in 1961 and 1975. It contains 21 classrooms. Two classrooms each are devoted to grades one through eight. There is a single classroom each for kindergarten (used for two sessions a day), music and special education. The facility includes a gymnasium and support rooms (Harkness 1990a and b; SPGMR 1989).

**Sweet Grass County High School**

Sweet Grass County High School serves students in ninth through twelfth grade countywide. Enrollment for the 1990-91 school year was 196 students. Table 3.14-10 shows enrollment by grade for school years 1984-85 to the present. These data indicate that enrollments have fluctuated within a narrow range below 200. Peak enrollment during the period was 196 students in 1987-88 and 1990-91; lowest enrollment was 181 in 1985-86.

The school has 21.9 FTE teachers. Four teachers handle grades seven and eight, and 13 teachers handle kindergarten through sixth grade. Part-time staff are retained for special education, speech, music, art and counseling (Harkness 1990a and b; SPGMR 1989).

TABLE 3.14-7

SCHOOL ENROLLMENT, SCHOOL YEARS 1980-81 TO 1988-89
SWEET GRASS COUNTY

| Grade | 1981-82 | 1982-83 | 1983-84 | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 |
|---|---|---|---|---|---|---|---|---|---|---|
| K | 40 | 51 | 41 | 46 | 50 | 50 | 39 | 45 | 45 | 47 |
| 1st | 46 | 48 | 52 | 48 | 52 | 46 | 48 | 41 | 44 | 45 |
| 2nd | 46 | 42 | 47 | 47 | 49 | 43 | 40 | 49 | 43 | 46 |
| 3rd | 41 | 45 | 43 | 49 | 48 | 47 | 44 | 43 | 44 | 41 |
| 4th | 43 | 41 | 47 | 44 | 52 | 46 | 47 | 43 | 43 | 44 |
| 5th | 47 | 50 | 43 | 48 | 46 | 51 | 47 | 48 | 41 | 42 |
| 6th | 62 | 51 | 50 | 50 | 55 | 50 | 52 | 42 | 47 | 38 |
| 7th | 43 | 63 | 53 | 50 | 48 | 61 | 50 | 54 | 43 | 45 |
| 8th | 41 | 41 | 58 | 50 | 46 | 46 | 56 | 47 | 54 | 42 |
| Total Elem. | 409 | 432 | 434 | 432 | 446 | 440 | 423 | 412 | 404 | 390 |
| 9th | 56 | 40 | 43 | 51 | 54 | 47 | 46 | 56 | 47 | 54 |
| 10th | 45 | 55 | 41 | 44 | 49 | 50 | 42 | 43 | 56 | 46 |
| 11th | 47 | 49 | 56 | 40 | 40 | 52 | 50 | 37 | 44 | 52 |
| 12th | 50 | 48 | 46 | 50 | 38 | 45 | 58 | 54 | 35 | 44 |
| Total H.S. | 198 | 192 | 186 | 185 | 181 | 194 | 196 | 190 | 182 | 196 |

Source: SPGMR 1989; Schott 1990; Webb 1990b.

TABLE 3.14-8

CLASS SIZES REQUIRED FOR ACCREDITATION
MONTANA BOARD OF PUBLIC EDUCATION

| | Maximum | |
|---|---|---|
| | Current | 1992 |
| Single-grade Classrooms | | |
| Kindergarten | 24 | 20 |
| Grade 1 | 26 | 20 |
| Grade 2 | 26 | 20 |
| Grades 3 and 4 | 28 | 28 |
| Grades 5 through 8 | 30 | 30 |
| High School[a] | 30 | 30 |
| One-teacher Schools | 18 | 18 |

[a] Besides class sizes for high schools, the state has established a maximum number of students per day a teacher may teach. For general classes, it is now 160 students and will become 150 in 1992. Teachers with heavy writing loads may teach only 100 students per day; this will not change in 1992. Lower class sizes may be set for laboratory classes such as chemistry, welding and music, at the discretion of the local school board.

Source: Neilson 1990.

TABLE 3.14-9

ENROLLMENT BY GRADE, 1984-85 TO 1990-91
BIG TIMBER GRADE SCHOOL

| Grade | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 |
|---|---|---|---|---|---|---|---|
| K | 40 | 34 | 40 | 31 | 37 | 36 | 31 |
| 1st | 39 | 46 | 33 | 40 | 33 | 35 | 35 |
| 2nd | 34 | 42 | 39 | 29 | 41 | 40 | 36 |
| 3rd | 42 | 38 | 41 | 39 | 32 | 35 | 34 |
| 4th | 35 | 46 | 37 | 40 | 38 | 33 | 37 |
| 5th | 43 | 40 | 46 | 37 | 39 | 37 | 35 |
| 6th | 42 | 51 | 43 | 48 | 36 | 37 | 37 |
| 7th | 45 | 44 | 55 | 43 | 51 | 40 | 43 |
| 8th | 50 | 41 | 43 | 53 | 54 | 51 | 40 |
| Total | 370 | 382 | 377 | 360 | 361 | 344 | 328 |

Source: Harkness 1990a and b; SPGMR 1989.

TABLE 3.14-10

ENROLLMENT BY GRADE, 1984-85 TO 1990-91
SWEET GRASS COUNTY HIGH SCHOOL

| Grade | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 |
|---|---|---|---|---|---|---|---|
| 9th | 52 | 54 | 47 | 46 | 56 | 47 | 54 |
| 10th | 44 | 49 | 50 | 42 | 43 | 56 | 46 |
| 11th | 39 | 40 | 52 | 50 | 37 | 44 | 52 |
| 12th | 50 | 38 | 45 | 58 | 54 | 35 | 44 |
| Total | 185 | 181 | 194 | 196 | 190 | 182 | 196[a] |

[a] Two more students expected by end of 1990.
Source: Webb 1990b; SPGMR 1989.

The school has 21.9 FTE teachers. Four teachers handle grades seven and eight, and 13 teachers handle kindergarten through sixth grade. Part-time staff are retained for special education, speech, music, art and counseling (Harkness 1990a and b; SPGMR 1989).

State standards for classroom capacity are presented in Table 3.14-8. However optimum standards for Big Timber Grade School are somewhat lower for two reasons. First, classrooms in the school are physically small. Classrooms in the original building are not large, and classrooms in the later additions are small by contemporary standards. Even the larger classrooms are perceived to be crowded when they contain 24 or 25 desks and a computer area. Second, because of stable or declining enrollments, district patrons expect to be able to maintain "locally optimal" students-per-classroom standards which have prevailed in the past, regardless of prospects for future growth.

According to the superintendent, optimal standards for the grade school are 20 students per class for kindergarten through third grade, 22 to 24 for fourth through sixth grade, and 24 to 26 for seventh and eighth grade (Harkness 1990a and b). Table 3.14-11 presents spaces available by grade vis a vis current state maximum standards, maximum standards taking effect for 1992-93, and locally optimal standards.

Under HB 28 funding levels which went into effect in 1990-91, Big Timber Grade School was able to accomplish maintenance and improvements which had been deferred under past budget constraints. The gym floor was resurfaced for the first time in 25 years, some computers were purchased (still more are needed, according to the superintendent), and some old desks and chalkboards were replaced. Some deferred maintenance tasks or improvements, which still must be undertaken, are roofing the building and installing a sprinkler system (Harkness 1990a and b).

The superintendent believes that additional instructional staff are needed. For example, the district currently has a half-time librarian but probably could use a full-time librarian. That means it is questionable whether one full-time librarian would be adequate if it were necessary to accommodate substantial enrollment growth in the future. Attracting staff has not been a problem lately for the Big Timber Grade School because the area is an attractive one in which to live. Turnover is small, and the district has hired only five or six teachers in ten years. However, special staff are at a premium, e.g., special education teachers, music teachers and librarians (Harkness 1990a and b).

Big Timber Elementary School contracts for student transportation through the high school, which operates the Big Timber school buses, and payment is in proportion to ridership. Because there are more elementary school children, most funding for student transportation comes from the elementary school (Harkness 1990a and b).

<u>McLeod Elementary School, District 29</u>

McLeod Elementary School serves students in kindergarten through eighth grade who live in the Boulder River drainage. The facility consists of two separate buildings, one from 1923 and the other from 1951, which have been tied together. There are two classrooms (which are small), a library, machine storage, and a kitchen (SPGMR 1989).

TABLE 3.14-11

AVAILABLE CAPACITY BY GRADE, 1990-91
BIG TIMBER GRADE SCHOOL

| Grade | Available Capacity by Grade: Assuming Current State Standard For Classroom Capacity | Assuming State Standard For Classroom Capacity Capacity In Effect as of 1992-93 School Year | Assuming Locally Optimal Standard For Classroom Capacity |
|---|---|---|---|
| K | 17 | 9 | 9 |
| 1st | 17 | 5 | 5 |
| 2nd | 16 | 4 | 4 |
| 3rd | 22 | 22 | 6 |
| 4th | 19 | 19 | 7 |
| 5th | 25 | 25 | 9 |
| 6th | 23 | 23 | 7 |
| 7th | 17 | 17 | 5 |
| 8th | 20 | 20 | 8 |
| Total | 176 | 144 | 60 |

Source: Harkness 1990a and b.

Table 3.14-12 presents enrollment at the school from 1984-85 to 1990-91. In 1988-89 enrollment was 15, and the school had two teachers. In 1989-90 enrollment dropped to six students, and one teacher was employed. In 1990-91, there are seven students and one teacher. Although enrollment has dropped recently, a few more students are expected in 1991-92 (Neilson 1990).

State standards allow a maximum of 18 students per teacher in one-teacher schools; McLeod is in effect two one-teacher schools, when both classrooms are operating. However, the classrooms are physically small, and their effective capacity is approximately 26 students, not 36 (Neilson 1990; SPGMR 1989).

Sweet Grass County High School

The high school classroom facility was completed in 1981. It has 17 classrooms and a design capacity of about 220 students. The gymnasium was completed in 1985. The buildings are still in good condition, and the district has kept up with preventive maintenance. As a result, only $8,000 to $10,000 worth of needed repairs are outstanding, a level which the district expects to be able to manage under present conditions (Webb 1990a).

The present staff includes 19 teachers, a superintendent, a half-time principal, a half-time chemistry and physics teacher, and a part-time athletic and activities director. The district has not had difficulty hiring teachers in the past, although it is harder to find special education, math, and science teachers because of a general shortage of personnel in these areas (Webb 1990a and b; SPGMR 1989).

Although designed for 220 students, the optimum working range for the high school facility is 190 to 200 students. The current student-teacher ratio is slightly more than 10 and the district has stayed within the range of 10 to 11.2 students per teacher for the last 10 to 12 years. At one time the high school had 200 students, and although the school functioned adequately, the building "was cramped in some areas" (Webb 1990a).

The student transportation system, which serves the high school and Big Timber Grade School, is adequate under present conditions. The district's policy is if students reside in Big Timber they are not eligible for transportation. The district operates one bus (a conventional 60-passenger Chevrolet school bus) to serve the Main Boulder River area. With 48 to 50 students on the passenger list at present, available capacity is limited on the Boulder route (Webb 1990a).

### 3.14.5 Local Government Fiscal Conditions

#### 3.14.5.1 Taxable Valuation: Sweet Grass County and City of Big Timber

The tax base in Sweet Grass County has varied little over the years. Table 3.14-13 presents taxable valuation for the county as a whole from 1973 through 1990. Taxable value in the county has declined recently. However, most of the decrease is the result of legislative actions (SPGMR 1989).

The tax base of other jurisdictions in Sweet Grass County varies little over time. Taxable value in the city of Big Timber also is presented in Table 3.14-13.

TABLE 3.14-12

ENROLLMENT BY GRADE, 1984-85 TO 1990-91
MCLEOD ELEMENTARY SCHOOL

| Grade | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 |
|---|---|---|---|---|---|---|---|
| K | 1 | 4 | 1 | 2 | 3 | 1 | 1 |
| 1st | 0 | 1 | 5 | 1 | 2 | 1 | 2 |
| 2nd | 3 | 0 | 1 | 5 | 0 | 0 | 2 |
| 3rd | 0 | 3 | 0 | 2 | 5 | 0 | 1 |
| 4th | 4 | 0 | 3 | 0 | 1 | 3 | 0 |
| 5th | 1 | 3 | 0 | 4 | 0 | 1 | 1 |
| 6th | 2 | 1 | 3 | 0 | 2 | 0 | 0 |
| 7th | 0 | 1 | 2 | 3 | 0 | 0 | 0 |
| 8th | 0 | 0 | 1 | 1 | 2 | 0 | 0 |
| Total | 11 | 13 | 16 | 18 | 15 | 6 | 7 |

Source: Schott 1990; SPGMR 1989.

TABLE 3.14-13

TAXABLE VALUE, 1973 TO 1990
SWEET GRASS COUNTY AND CITY OF BIG TIMBER

| Year | County | City |
|---|---|---|
| 1973 | $7,068,160 | $1,549,958 |
| 1974 | 7,588,416 | 1,658,274 |
| 1975 | 7,345,026 | 1,765,542 |
| 1976 | 6,928,157 | 1,552,557 |
| 1977 | 6,943,167 | 1,462,569 |
| 1978 | 6,746,691 | 1,519,443 |
| 1979 | 7,325,454 | 1,503,674 |
| 1980 | 8,270,469 | 1,561,175 |
| 1981 | 7,416,592 | 1,551,172 |
| 1982 | 7,308,110 | 1,425,555 |
| 1983 | 6,711,826 | 1,361,325 |
| 1984 | 6,708,893 | 1,389,440 |
| 1985 | 6,912,972 | 1,441,023 |
| 1986 | 7,464,298 | 1,740,852 |
| 1987 | 7,320,052 | 1,741,664 |
| 1988 | 7,014,214 | 1,738,951 |
| 1989 | 7,733,217 | 1,871,561 |
| 1990 | 7,725,165 | 1,760,497 |

Source: Becken 1990b.

Table 3.14-14 presents the market value and taxable value of property in Sweet Grass County for 1988 through 1990 broken down into the various components. Agricultural property (land, buildings, livestock, and machinery) is the most important component of the Sweet Grass County tax base, comprising about 42 percent of taxable valuation in 1990. Residential types of property (city residential, small tract residential and mobile homes) comprised 20 percent of the tax base in 1990, and commercial and industrial property comprised about 6 percent.

### 3.14.5.2 Sweet Grass County Fiscal Conditions

Sweet Grass County provides the bulk of its tax supported services through five key funds: general, road, bridge, poor, and district court. The general fund supported 20 FTE employees in fiscal year 1991, the road fund 7 and the district court fund 4.

A number of specific activities, many of which are partially funded by special allocations or grants from the State of Montana, are handled through a variety of special revenue funds. Some special revenue funds receive significant revenues from charges for services. An example is the ambulance fund which is staffed with 14 on-call EMTs (the equivalent of 6 FTE employees).

The county also owns and operates the Pioneer Nursing Home and accounts for it in an enterprise fund. The nursing home budget supported 26 permanent FTE (full-time equivalent) employees in fiscal year 1991.

County debt is minimal; a bond issue for improvements at the nursing home has a small remaining balance and will be paid off after two more years.

One special revenue fund, the planning fund, has grown over the past two years, apparently in response to the proposed action. A mill levy is assessed for this fund, but an approximately equal amount is received as an annual grant from the mine proponent. The city of Big Timber also contributes a significant amount to this fund. The planning fund supports one FTE employee.

Table 3.14-15 presents Sweet Grass County expenditure appropriations for the current and two past years in nominal dollars. Expenditure appropriations as a whole have grown about 9 percent per year during the period, with individual departments growing above or below that average. It may be noted that appropriations from the general fund have been relatively constrained, growing only about 2 percent per year during the period, considerably less than the 5 percent maximum allowed by statute in the wake of Initiative 105, the tax limitation amendment passed in 1986.

For most county operating funds, actual expenditures during the year are about the same as the fund's budgeted appropriation. However, the level of appropriation is misleading for some funds since the county maintains a large carryover balance, appropriates all available resources, but spends at a level more closely approximating actual new revenues to the fund.

Examples of this practice are the gas tax fund, which receives state-shared revenues, and the PILT fund, which receives annual "payments in lieu of taxes" from the federal government. Expenditures from the gas tax fund are used to purchase materials and supplies for road and bridge projects. Appropriations from the PILT fund generally are transferred to other funds and then expended. Funds receiving PILT transfers in fiscal year 1991 are the road, district court, alcohol rehabilitation, and ambulance funds (Scholten 1990b).

TABLE 3.14-14
MARKET VALUE AND TAXABLE VALUE BY CATEGORY, 1988 TO 1990
SWEET GRASS COUNTY

| Market Value | 1988 | 1989 | 1990 | % of Tot 1990 |
|---|---|---|---|---|
| Grazing | $ 2,917,059 | $ 2,924,267 | $ 2,922,854 | 2.2 |
| Other Ag Land | 1,789,649 | 1,809,522 | 1,793,311 | 1.3 |
| Bldgs on Ag Land | 28,914,266 | 29,310,951 | 29,529,628 | 21.9 |
| Livestock | 11,270,181 | 12,545,021 | 12,902,907 | 9.6 |
| Farm Machinery | 4,195,200 | 4,288,745 | 4,901,403 | 3.6 |
| Small Tracts | 11,140,793 | 11,432,166 | 12,139,636 | 9.0 |
| Mobile Homes | 1,247,583 | 1,206,601 | 1,204,409 | 0.9 |
| City Residential | 27,656,173 | 28,044,393 | 27,865,821 | 20.7 |
| Commercial | 12,740,960 | 12,773,617 | 11,895,531 | 8.8 |
| Industrial | 844,262 | 728,595 | 920,574 | 0.7 |
| Utilities | 6,954,209 | 6,907,048 | 7,269,974 | 5.4 |
| Railroad | 4,386,579 | 9,971,658 | 9,971,649 | 7.4 |
| Net/Gross Proceeds | 0 | 0 | 0 | 0 |
| Other | 2,363,488 | 5,487,602 | 6,270,136 | 4.7 |
| Co-op Utilities | 5,958,333 | 5,374,311 | 5,387,434 | 4.0 |
| Total* | $122,378,735 | $132,804,497 | $134,975,267 | 100% |

| Taxable Value | 1988 | 1989 | 1990 | % of Tot 1990 |
|---|---|---|---|---|
| Grazing | $ 875,295 | $ 877,474 | $ 877,086 | 11.4 |
| Other Ag Land | 494,309 | 500,814 | 495,400 | 6.4 |
| Bldgs on Ag Land | 892,032 | 906,092 | 909,700 | 11.8 |
| Livestock | 450,785 | 501,785 | 512,139 | 6.6 |
| Farm Machinery | 461,475 | 471,766 | 441,153 | 5.7 |
| Small Tracts | 429,996 | 440,607 | 467,195 | 6.1 |
| Mobile Homes | 46,851 | 44,536 | 44,789 | 0.6 |
| City Residential | 1,030,777 | 1,047,287 | 1,041,289 | 13.5 |
| Commercial | 491,804 | 493,065 | 459,159 | 5.9 |
| Industrial | 19,592 | 20,147 | 30,553 | 0.4 |
| Utilities | 834,508 | 828,844 | 872,399 | 11.3 |
| Railroad | 481,207 | 789,756 | 746,876 | 9.7 |
| Net/Gross Proceeds | 0 | 0 | 0 | 0 |
| Other | 350,005 | 641,763 | 665,798 | 8.6 |
| Co-op Utilities | 155,578 | 161,229 | 161,629 | 2.1 |
| Total* | $ 7,014,214 | $ 7,725,165 | $ 7,725,165 | 100% |

Percentages may not add to 100% due to rounding.
Source: Becken 1990a.

TABLE 3.14-15

APPROPRIATED EXPENDITURES, FY 1989 TO FY 1991
SWEET GRASS COUNTY

| Fund | Approp FY 1989 | Approp FY 1990 | Approp FY 1991 | % Chg FY 89-90 | % Chg FY 90-91 | % Chg FY 89-91 | Avg % Chg FY 89-91 | Pr Act Exp of Appr |
|---|---|---|---|---|---|---|---|---|
| General | $ 504,050 | $ 509,660 | $ 523,130 | 1.1% | 2.6% | 3.8% | 1.9% | 0.93 |
| Road | 156,050 | 167,410 | 179,410 | 7.3% | 7.2% | 15.0% | 7.2% | 0.97 |
| Poor | 58,070 | 63,750 | 60,910 | 9.8% | -4.5% | 4.9% | 2.4% | 0.69 |
| Bridge | 36,660 | 41,810 | 54,000 | 14.0% | 29.2% | 47.3% | 21.4% | 0.53 |
| District Court | 57,000 | 59,970 | 62,450 | 5.2% | 4.1% | 9.6% | 4.7% | 0.93 |
| Hospital | 35,900 | 45,900 | 40,000 | 27.9% | -12.9% | 11.4% | 5.6% | 0.80 |
| Weed Control | 28,930 | 32,520 | 41,000 | 12.4% | 26.1% | 41.7% | 19.0% | 0.77 |
| Fair | 14,600 | 14,670 | 21,900 | 0.5% | 49.3% | 50.0% | 22.5% | 1.07 |
| Airport | 24,600 | 24,490 | 24,920 | -0.4% | 1.8% | 1.3% | 0.6% | 0.13 |
| Ambulance | 36,600 | 50,800 | 46,500 | 38.8% | -8.5% | 27.0% | 12.7% | 0.86 |
| Cemetery | 35,290 | 36,780 | 38,290 | 4.2% | 4.1% | 8.5% | 4.2% | 0.77 |
| Count Ext Agent | 32,730 | 33,050 | 36,000 | 1.0% | 8.9% | 10.0% | 4.9% | 0.95 |
| Alcohol Rehab | 23,660 | 25,800 | 25,900 | 9.0% | 0.4% | 9.5% | 4.6% | 0.99 |
| Fire Protection | 31,920 | 28,280 | 28,760 | -11.4% | 1.7% | -9.9% | -5.1% | 0.73 |
| Planning | 15,800 | 28,200 | 42,980 | 78.5% | 52.4% | 172.0% | 64.9% | 0.77 |
| Library | 12.830 | 12,970 | 13,920 | 1.1% | 7.3% | 8.5% | 4.2% | 1.00 |
| Gas Tax | 222,620 | 271,470 | 312,440 | 21.9% | 15.1% | 40.3% | 18.5% | 0.03 |
| PILT | 267,700 | 308,480 | 330,450 | 15.2% | 7.1% | 23.4% | 11.1% | 0.55 |
| Pioneer Nrsg Hme | 713,200 | 858,000 | 884,140 | 20.3% | 3.0% | 24.0% | 11.3% | 0.92 |
| Other Funds | 110,810 | 114,140 | 130,090 | 3.0% | 14.0% | 17.4% | 8.4% | 0.55 |
| Total | $2,419,020 | $2,728,150 | $2,897,190 | 12.8% | 6.2% | 19.8% | 9.4% | 0.75 |

Source: Sweet Grass County 1990; Sweet Grass County 1989; SPGMR 1989.

Table 3.14-16 presents budgeted revenues for Sweet Grass County for fiscal years 1989 through 1991 for five key funds and for the remaining funds combined. The five key funds are heavily supported by local property taxes (about 41 percent or more) compared to the "other funds" category which is dominated by the nursing home enterprise fund which receives no local property taxes. Because roads in the city of Big Timber are maintained by the city, the county road levy may be applied only to property outside the city limits. The two county and city road maintenance operations remain separate although there has been informal consideration in the past of cooperation on a city-county shop (Scholten 1990b; Sweet Grass County 1990).

The single most important source of other revenue to the general fund is allocation from the city of Big Timber for the county sheriff's police services. Dedicated local taxes, state-shared taxes and court fines, and recording fees are significant other revenues to the General Fund. The road fund receives motor vehicle plate fees and federal forest reserve payments. Small annual state grants are received by the junk vehicle, child health, community services, and public transportation funds. The communications fund receives a payment from the state highway department as a share in the operations of the radio communication tower used by the sheriff, civil defense, ambulance and fire protection services (Sweet Grass County 1990).

Fees, fines and some taxes, such as the motor vehicle plate fee, ad valorem motor vehicle tax, and light vehicle tax grow in proportion to population. Revenues such as the state-shared gas tax and PILT revenues are independent of population growth. Revenues such as the city allocation for sheriff's services and the Forest Service payment for sheriff's services patrolling the Boulder River Road are set by agreement. The cemetery, ambulance, and nursing home all receive fees for service. In the case of the nursing home, revenues generally cover expenses, but fees were raised recently in order to begin a building fund (Scholten 1990b; Sweet Grass County 1990).

When comparing appropriated expenditures with budgeted revenues (including available cash), note that the excess of revenues over expenditures generally represents a reserve to tide the county over between the end of the fiscal year in June and the November due date for the first tax payment of the new fiscal year.

#### 3.14.5.3 City of Big Timber Fiscal Conditions

Services provided by the city of Big Timber are accounted for in a general fund and three enterprise funds (one each for water, sewer, and solid waste). The general fund is supported by an all-purpose property tax levy of 84.13 mills, locally generated revenues from licenses, permits, fines and charges for services, and revenues contributed by the state of Montana and Sweet Grass County. As noted in the previous description of facilities and services provided by the city of Big Timber, costs for the services of the city's employees are spread across the various funds in proportion to time expended on various activities.

As of October 1, 1990, Big Timber had a bonded indebtedness of $568,000 in the form of outstanding sewer and water revenue bonds. In order to finance the proposed new landfill, the city was preparing to issue an additional $450,000 in revenue bonds.

TABLE 3.14-16

BUDGETED REVENUES, FY 1989 TO FY 1991
SWEET GRASS COUNTY

| General Fund | FY 1989 | FY 1990 | FY 1991 | % of Tot FY 1989 | % of Tot FY 1990 | % of Tot FY 1991 |
|---|---|---|---|---|---|---|
| Mill Levy | 37.88 | 35.07 | 34.68 | | | |
| Property Taxes | $ 265,700 | $ 271,203 | $ 267,670 | 44% | 43% | 42% |
| Other Revenues | 225,275 | 229,779 | 234,383 | 37% | 36% | 36% |
| Cash Available | 116,680 | 132,319 | 141,396 | 19% | 21% | 22% |
| Total | $ 607,655 | $ 633,301 | $ 643,449 | 100% | 100% | 100% |
| **Road Fund** | | | | | | |
| Mill Levy | 18.00 | 18.00 | 18.00 | | | |
| Property Taxes | $ 94,950 | $ 105,510 | $ 110,774 | 65% | 52% | 52% |
| Other Revenues | 22,500 | 63,500 | 67,858 | 15% | 31% | 32% |
| Cash Available | 27,780 | 35,162 | 34,964 | 19% | 17% | 16% |
| Total | $ 145,230 | $ 204,172 | $ 213,596 | 100% | 100% | 100% |
| **Bridge Fund** | | | | | | |
| Mill Levy | 3.15 | 3.57 | 3.69 | | | |
| Property Taxes | $ 22,090 | $ 27,640 | $ 28,470 | 50% | 55% | 44% |
| Other Revenues | 2,260 | 2,875 | 3,462 | 5% | 6% | 5% |
| Cash Available | 19,650 | 19,654 | 32,868 | 45% | 39% | 51% |
| Total | $ 44,000 | $ 50,169 | $ 64,800 | 100% | 100% | 100% |
| **Poor Fund** | | | | | | |
| Mill Levy | 1.93 | 6.13 | 4.45 | | | |
| Property Taxes | $ 13,550 | $ 47,374 | $ 34,373 | 19% | 62% | 45% |
| Other Revenues | 2,990 | 2,182 | 5,438 | 4% | 3% | 7% |
| Cash Available | 53,140 | 26,946 | 36,070 | 76% | 35% | 48% |
| Total | $ 69,680 | $ 76,502 | $ 75,881 | 100% | 100% | 100% |
| **District Court** | | | | | | |
| Mill Levy | 4.00 | 4.00 | 4.00 | | | |
| Property Taxes | $ 28,060 | $ 30,933 | $ 30,874 | 41% | 44% | 41% |
| Other Revenues | 34,040 | 31,015 | 29,104 | 50% | 45% | 39% |
| Cash Available | 6,300 | 7,682 | 14,575 | 9% | 11% | 20% |
| Total | $ 68,400 | $ 69,630 | $ 74,553 | 100% | 100% | 100% |
| **Other Funds** | | | | | | |
| Mill Levy | 22.83 | 27.83 | 27.53 | | | |
| Property Taxes | $ 159,670 | $ 203,890 | $ 195,408 | 8% | 10% | 9% |
| Other Revenues | 1,115,149 | 1,184,688 | 1,258,563 | 59% | 58% | 57% |
| Cash Available | 617,231 | 671,161 | 748,515 | 33% | 33% | 34% |
| Total[a] | $1,892,050 | $2,059,739 | $2,202,486 | 100% | 100% | 100% |

[a] Percentages may not add to 100% due to rounding.

Source: Sweet Grass County, 1990; Sweet Grass County, 1989; SPGMR, 1989.

Table 3.14-17 presents Big Timber's expenditure appropriations for the current and two past budget years in nominal dollars. Expenditure appropriations as a whole have grown about 4.5 percent per year during the period, with individual functions growing at rates which vary around that average. It may be noted that appropriations from the general fund have grown at about 10 percent per year for the past two years largely due to increasing appropriations for the general government function.

Table 3.14-18 presents Big Timber's estimated revenues for the current and two past fiscal years in nominal dollars. With the mill levy frozen at 1986 levels, property taxes fluctuate within a narrow range, based on small year-to-year changes in the city's taxable valuation. Other general fund revenue sources also have remained flat. Among the utilities, Big Timber's water fund has done well with estimated revenues increasing somewhat while expenditure appropriations have declined slightly. The city recently raised sewer rates by 10 percent, and solid waste disposal fees were increased by about 72 percent overall last year in preparation for the upcoming revenue bond issue for the new landfill (Bjorndal 1990).

Despite the Initiative 105 freeze and limited sources of local revenue, the city has avoided a budget crunch for the past four years through prudent management, according to Bjorndal (1990). Although expenditure appropriations exceed budgeted revenues in fiscal years 1989 and 1991, the city has been able to increase its actual fund balances at the end of fiscal years 1989 and 1990 each year by containing spending, avoiding costs for purchased services by doing mechanical work in house, and enhancing total available revenue through interest earnings on city funds (Bjorndal 1990).

Big Timber's bonded indebtedness consisted of the following as of the end of October, 1990: $24,000 remaining on a 1974 issue of $120,000 in water revenue bonds to be paid off in 1994, $435,000 remaining on a 1979 issue of $605,000 in water revenue bonds to be paid off in 1999, and $109,000 remaining on a 1981 issue of $135,000 in sewer revenue bonds to be paid off in 2001. At present, annual debt service requirements are approximately $89,500.

For the water and sewer utilities, Big Timber maintains an operating fund, a replacement and depreciation fund, and a debt service, or revenue bond, fund. The city also has established a construction fund for the solid waste utility which will receive the proceeds of the sale of revenue bonds to be issued to build the new landfill.

Utility revenues are generated overwhelmingly by the residential customers of the system. There are no major commercial or industrial users. As noted in Subsection 3.14.4 on Local Government Facilities and Services, user charges are flat rates based on the size of service, not on demand. Hookup charges are minimal, are not intended to cover the replacement cost of capacity purchased, and in most cases do not cover the full cost of making the hookup. Water rates are $25.47 per quarter for a house with five rooms and one bathroom, $14.56 per quarter for sewer and $33.00 per quarter for garbage. A $40.51 irrigation fee for lawn watering is added to the quarterly utility bill for July, August, and September. Hookup charges for a new service are $150 for water and $50 for sewer (Bjorndal 1990; Thomas 1990).

TABLE 3.14-17

APPROPRIATED EXPENDITURES, FY 1989 TO FY 1991
CITY OF BIG TIMBER

| | Approp FY 1989 | Approp FY 1990 | Approp FY 1991 | % Chg FY 89-90 | % Chg FY 90-91 | % Chg FY 89-91 | Avg % Chg FY 89-91 |
|---|---|---|---|---|---|---|---|
| General Govt | $ 69,570 | $ 81,530 | $ 94,600 | 17.2 | 16.0 | 36.0 | 16.6 |
| Public Safety | 98,030 | 101,030 | 96,090 | 3.1 | -4.9 | -2.0 | -1.0 |
| Pub Wrks/Gas Tax | 94,260 | 107,100 | 112,460 | 13.6 | 5.0 | 19.3 | 9.2 |
| Public Health | 6,050 | 6,800 | 6,900 | 12.4 | 1.5 | 14.0 | 6.8 |
| Culture/Rec | 50,570 | 32,720 | 59,500 | -35.3 | 81.8 | 17.7 | 8.5 |
| Total Gen Fund | 318,480 | 329,180 | 369,550 | 3.4 | 12.3 | 16.0 | 7.7 |
| Water Funds | 159,210 | 163,160 | 152,360 | 2.5 | -6.6 | -4.3 | -2.2 |
| Sewer Funds | 71,630 | 71,130 | 78,130 | -0.7 | 9.9 | 9.1 | 4.4 |
| Solid Waste Funds[a] | 84,090 | 80,250 | 90,370 | -4.6 | 12.6 | 7.5 | 3.7 |
| Other Funds | 3,000 | 2,900 | 3,710 | -3.3 | 27.9 | 23.7 | 11.2 |
| Total All Funds | $636,410 | $646,620 | $694,120 | 1.6 | 7.3 | 9.1 | 4.4 |

Note:

[a] Exclude appropriations: $93,344 in FY 1989, $202,000 in FY 1990 and $199,755 in FY 1991.

Source: City of Big Timber 1989b, 1990c and 1990d.

TABLE 3.14-18

BUDGETED REVENUES, FY 1989 TO FY 1991
CITY OF BIG TIMBER

| | FY 1989 | FY 1990 | FY 1991 | % of Tot FY 1989 | % of Tot FY 1990 | % of Tot FY 1991 |
|---|---|---|---|---|---|---|
| Prop Tax Revenue | $150,640 | $142,300 | $151,920 | 54 | 42 | 48 |
| Other Tax Revenue | 8,490 | 30,880 | 39,100 | 3 | 9 | 12 |
| Lics/Permits | 27,080 | 10,780 | 10,880 | 10 | 3 | 3 |
| Intgvt Rev/Gas Tax | 73,970 | 93,240 | 84,740 | 27 | 28 | 27 |
| Service Charges | 3,050 | 2,550 | 3,650 | 1 | 1 | 1 |
| Fines/Forfeitures | 4,300 | 3,300 | 3,700 | 2 | 1 | 1 |
| Miscellaneous | 11,000 | 52,800 | 24,950 | 4 | 16 | 8 |
| Total General Fund[a] | 278,530 | 335,850 | 318,990 | 100 | 100 | 100 |
| Water Funds | 150,000 | 154,100 | 157,300 | | | |
| Sewer Funds | 60,400 | 61,800 | 68,200 | | | |
| Solid Waste Funds[a] | 91,000 | 93,570 | 95,200 | | | |
| Other Funds | 6,590 | 6,400 | 8,320 | | | |
| Total All Funds | $586,520 | $651,720 | $648,010 | | | |

[a] Exclude estimated revenues for new landfill: $150,000 in FY 1989, $200,000 in FY 1990 and $300,000 in FY 1991.

Source: City of Big Timber, 1989a, 1990a and 1990b.

Within each utility, revenues from service and connection charges are allocated to the three funds in proportion to budgeted expenditure appropriations. Costs for operating the utilities have been consistent and predictable over the years. Also over the past 13 years, resources in the replacement and depreciation funds generally have been adequate to cover unusual repairs as they come up. The sewer system has been an exception, to some degree, and a recent increase in sewer rates was implemented in order to fund the sewer replacement and depreciation fund at a higher level. However, even with the increase, the fund is still for unusual repairs and is not being expected to pay for the sewer system upgrade which the city believes is needed (as noted in Subsection 3.14.4 on Local Government Facilities and Services) (Bjorndal 1990).

### 3.14.5.4 Big Timber Grade School Fiscal Conditions

Big Timber Grade School had enrollments of 361 in 1988-89, 344 in 1989-90, and 328 in 1990-91. Table 3.14-19 presents the elementary school district's expenditure appropriations by fund for fiscal years 1988-89 through 1990-91. All the current costs of operating the elementary school are budgeted in the general and transportation funds. In 1988-89, the district levied 41.79 mills for the general and comprehensive insurance funds combined and 51.86 total mills (in districts 1R and 1C), 43.45 mills for the general and insurance funds and 52.041 total mills (1R and 1C) in 1989-90, and 35.65 mills for the general fund (including insurance) in 1990-91 (Big Timber Grade School 1988 and 1989).

The general fund contains costs for instruction, educational media, administration, operations and maintenance, special programs, and extracurricular activities. The transportation fund primarily contains the amount paid to Sweet Grass County High School for transportation services.

In fiscal year 1990-91, expenditure appropriations have increased markedly over previous years. This reflects the more liberal spending allowances enacted by the 1989 state legislature in HB 28 which exempted schools from the restrictions of Initiative 105 of 1986. Under the new budget limits, the grade school has been able to budget for salary and other cost increases, plus a number of improvements, which were deferred under the previous budget limits.

Also starting in fiscal year 1990-91, the general fund includes comprehensive insurance costs for the school district which previously were accounted for in a separate fund. In the table, expenditure for fiscal years 1988-89 and 1989-90 have been adjusted to make them comparable to fiscal year 1990-91 (SPGMR 1989).

Table 3.14-20 presents Big Timber Grade School estimated revenues for fiscal years 1988-89 through 1990-91. General fund revenues are broken down by broad revenue category. It may be noted that the foundation program as a whole contributes a significantly larger proportion of general fund revenues for fiscal 1990-91 (85 percent versus 73 percent in 1988-89 and 1989-90), reflecting the provisions of HB 28. HB 28 also created the guaranteed tax base, a payment through which the state makes up the difference for districts in which the taxable value per student is less than the state average (SPGMR 1989).

State-contributed revenues (state foundation and guaranteed tax base payments combined) were 65 percent of the general fund for Big Timber Grade School in fiscal year 1990-91, up from 51 percent in fiscal year 1989-90. Local property taxes--whether generated by the 33 mill elementary school foundation levy or by the local permissive levy (35.65 mills in fiscal year 1990-91)--were 33 percent of the general fund revenue base in 1990-91.

TABLE 3.14-19
EXPENDITURE APPROPRIATIONS, FY 1989 TO FY 1991
BIG TIMBER GRADE SCHOOL

| | FY 1989 | FY 1990 | FY 1991 | % Change FY '89-90 | % Change FY '90-91 | % Change FY '89-91 |
|---|---|---|---|---|---|---|
| Gen Fund/Comp Ins | $831,210 | $ 838,100 | $1,033,450 | 0.8% | 23.3% | 11.5% |
| Transportation | 29,000 | 27,000 | 27,000 | -6.9% | 0.0% | -3.5% |
| Retirement | 109,000 | 126,000 | 128.250 | 15.6% | 1.8% | 8.5% |
| Building Reserve | 10,000 | 10,000 | 10,000 | 0.0% | 0.0% | 0.0% |
| Debt Service | 9,750 | 9,330 | 8,920 | -4.3% | -4.4% | -4.4% |
| Tuition | 1,900 | 6,600 | 6,720 | | | |
| Total | $990,860 | $1,017,030 | $1,214,340 | 2.6% | 19.4% | 10.7% |

Source: Big Timber Grade School 1988, 1989 and 1990.

Given the funding structure under HB 28, what proportion of the general fund will be paid by state aid versus local taxes in the future will depend on whether additional taxable value per additional student is higher or lower than the currently prevailing ratio. Incremental taxable value per student will affect both the state share of foundation schedule amounts and the state's guaranteed tax base subsidy per mill.

Big Timber Grade School had about $32,000 in bonded indebtedness in fiscal year 1989-90. Annual debt service payments are about $9,000, principal and interest, with payoff scheduled for fiscal year 1993-94 (SPGMR 1989; Harkness 1990a).

In 1981, the school district voted to create a building reserve and approved a levy to fund annual deposits of $10,000 for 20 years (the tenth payment to the fund will be made in fiscal year 1990-91). The fund was established with future impacts in mind but is intended for architectural and construction management services, not building construction per se (Harkness 1990a).

If substantial growth in the district were to require major expansion, bonds would have to be issued, absent other funding. Previous bond issues for construction of the high school and gymnasium were successful, but Harkness (1990a) feels that resistance may be growing to adding to the total property tax burden in his district.

### 3.14.5.5 McLeod Elementary School Fiscal Conditions

The McLeod Elementary School had enrollments of 15 in 1988-89, 6 in 1989-90, and 7 in 1990-91. A few more students are expected to attend in 1991-92 (Neilson 1990).

Table 3.14-21 presents expenditure appropriations and Table 3.14-22 presents estimated revenues for the district for fiscal years 1988-89 through 1990-91.

TABLE 3.14-20

ESTIMATED REVENUES, FY 1989 TO FY 1991
BIG TIMBER GRADE SCHOOL

| | FY 1989 | FY 1990 | FY 1991 | % of Tot FY 1989 | % of Tot FY 1990 | % of Tot FY 1991 |
|---|---|---|---|---|---|---|
| Fndtn Prgrm: State | $439,200 | $ 429,730 | $ 584,270 | 53% | 51% | 57% |
| Guaranteed Tax Base | | | 79,470 | 0% | 0% | 8% |
| Fndtn Prgrm: County | 167,680 | 180,350 | 204,620 | 20% | 22% | 20% |
| Local Property Tax | 159,700 | 178,210 | 134,940 | 19% | 21% | 13% |
| Other Local Revenue | 64,630 | 49,810 | 30,190 | 8% | 6% | 3% |
| Total Gen Fund/Comp Ins | 831,210 | 838,100 | 1,033,490 | 100% | 100% | 100% |
| Transportation | 29,000 | 27,000 | 27,000 | | | |
| Retirement | 109,000 | 126,000 | 128,250 | | | |
| Building Reserve | 10,000 | 10,000 | 10,000 | | | |
| Debt Service | 9,750 | 9,330 | 8,920 | | | |
| Tuition | 1,900 | 6,600 | 6,720 | | | |
| Total | $990,860 | $1,017,030 | $1,214,380 | | | |

Source: Big Timber Grade School 1988, 1989 and 1990.

TABLE 3.14-21

EXPENDITURE APPROPRIATIONS, FY 1989 TO FY 1991
MCLEOD ELEMENTARY SCHOOL

| | FY 1989 | FY 1990 | FY 1991 | % Change FY '89-90 | % Change FY '90-91 | % Change FY '89-91 |
|---|---|---|---|---|---|---|
| Gen Fund/Comp Ins | $ 42,300 | $ 42,300 | $ 41,600 | 0.0% | -1.7% | -0.8% |
| Transportation | 3,100 | 3,100 | 3,200 | 0.0% | 3.2% | 1.6% |
| Retirement | 4,100 | 4,300 | 3,970 | 4.9% | -7.7% | -1.6% |
| Total | $ 49,500 | $ 49,700 | $ 48,770 | 0.4% | -1.9% | -0.7% |

Source: SPGMR 1989; McLeod Elementary School 1989 and 1990.

TABLE 3.14-22

ESTIMATED REVENUES, FY 1989 TO FY 1991
MCLEOD ELEMENTARY SCHOOL

| | FY 1989 | FY 1990 | FY 1991 | % of Tot FY 1989 | % of Tot FY 1990 | % of Tot FY 1991 |
|---|---|---|---|---|---|---|
| Foundation Program | $ 30,870 | $ 31,690 | NA | 73% | 75% | NA |
| Guaranteed Tax Base | | | NA | 0% | 0% | NA |
| Local Property Tax | 7,090 | 3,700 | NA | 17% | 9% | NA |
| Other Local Revenue | 4,340 | 6,910 | NA | 10% | 16% | NA |
| Total Gen Fund/Comp Ins | 42,300 | 42.300 | NA | 100% | 100% | NA |
| Transportation | 3,100 | 3,100 | NA | | | |
| Retirement | 4,100 | 4,300 | NA | | | |
| Total | $ 49,500 | $ 49,700 | NA | | | |

Source: SPGMR 1989; McLeod Elementary School 1989 and 1990.

The McLeod school's budget requirements are limited since the district currently employs one teacher and no other staff members. The general fund includes a budget for instructional services (teacher's salary, fringes, textbooks and supplies), minimal general administrative support, operating and maintaining the school building, and a small amount for student field trips. The transportation fund covers payments to other districts and payments to individuals for transportation services. Comparison of the budget data available indicates that the cost of operating the school is consistent so long as the number of students does not require a second classroom or hiring additional staff.

#### 3.14.5.6 Sweet Grass County High School Fiscal Conditions

Sweet Grass County High School had enrollments of 190 in 1988-89, 182 in 1989-90 and 196 in 1990-91. Table 3.14-23 presents the school district's expenditure appropriations by fund for fiscal years 1988-89 through 1990-91. All the current costs of operating the high school are budgeted in the general and transportation funds. In 1988-89, the high school district levied 29.18 mills for the general fund and comprehensive insurance fund combined, and 67.08 total mills, 37.53 mills for the general and insurance funds and 70.27 total mills in 1989-90, and 31.96 mills for the general fund (including insurance) in 1990-91 (Sweet Grass County High School 1988, 1989, and 1990).

TABLE 3.14-23

EXPENDITURE APPROPRIATIONS, FY 1989 TO FY 1991
SWEET GRASS COUNTY HIGH SCHOOL

| | FY 1989 | FY 1990 | FY 1991 | % Change FY '89-90 | % Change FY '90-91 | % Change FY '89-91 |
|---|---|---|---|---|---|---|
| Gen Fund/Comp Ins | $ 764,190 | $ 796,205 | $ 947,720 | 4.2% | 19.0% | 11.4% |
| Transportation | 109,905 | 109,570 | 117,520 | -0.3% | 7.3% | 3.4% |
| Retirement | 99,300 | 103,680 | 114,920 | 4.4% | 10.8% | 7.6% |
| Bus Reserve | 162,890 | 143,900 | 135,840 | -11.7% | -5.6% | -8.6% |
| Debt Service | 262,770 | 254,340 | 183,560 | -3.2% | -27.8% | -16.4% |
| Total | $1,399,055 | $1,407,695 | $1,499,560 | 0.6% | 6.5% | 3.5% |

Source: Sweet Grass County High School 1988, 1989 and 1990.

The general fund contains costs for instructional programs and support services, operations and maintenance of the physical plant, special education, special programs, vocational education, and school-sponsored activities and athletics. The transportation fund contains costs for operating school buses, including general and business administrative support, drivers' salaries, repair and maintenance, insurance and fuel.

In fiscal year 1990-91, expenditure appropriations have increased markedly over previous years. This reflects the more liberal spending allowances enacted by the 1989 state legislature in HB 28 which exempted schools from the restrictions of Initiative 105 of 1986. Under the new budget limits, the high school has been able to budget for salary and other cost increases which were deferred under the previous budget limits.

Also starting in fiscal year 1990-91, the general fund includes comprehensive insurance costs for the school district which previously were accounted for in a separate fund. In the table, expenditure for fiscal years 1988-89 and 1989-90 have been adjusted to make them comparable to fiscal year 1990-91 (SPGMR 1989).

Table 3.14-24 presents Sweet Grass County High School estimated revenues for fiscal years 1988-89 through 1990-91. General fund revenues are broken down by broad revenue category. It may be noted that the state foundation program contributes a significantly larger proportion of general fund revenues for fiscal 1990-91, reflecting the provisions of HB 28. HB 28 also created the guaranteed tax base, a payment through which the state makes up the difference for districts in which the taxable value per student is less than the state average (SPGMR 1989).

TABLE 3.14-24

ESTIMATED REVENUES, FY 1989 TO FY 1991
SWEET GRASS COUNTY HIGH SCHOOL

| | FY 1989 | FY 1990 | FY 1991 | % of Tot FY 1989 | % of Tot FY 1990 | % of Tot FY 1991 |
|---|---|---|---|---|---|---|
| Fndtn Prgrm: State | $ 393,870 | $ 267,940 | $ 433,620 | 43% | 34% | 46% |
| Guaranteed Tax Base | | | 20,000 | 0% | 0% | 2% |
| Fndtn Prgrm: County | 115,810 | 134,310 | 165,770 | 13% | 17% | 17% |
| Local Property Tax | 270,265 | 357,970 | 299,020 | 31% | 45% | 32% |
| Other Local Revenue | 100,065 | 36,000 | 29,310 | 11% | 5% | 3% |
| Total Gen Fund/Comp Ins[a] | 880,010 | 796,220 | 947,720 | 100% | 100% | 100% |
| Transportation | 109,905 | 109,570 | 117,520 | | | |
| Retirement | 99,300 | 103,680 | 114,920 | | | |
| Bus Reserve | 162,890 | 143,900 | 135,840 | | | |
| Debt Service | 262,770 | 254,340 | 183,560 | | | |
| Total | $1,514,875 | $1,407,710 | $1,499,560 | | | |

[a] Percentages may not add to 100% due to rounding.
Source: Sweet Grass County High School 1988, 1989 and 1990.

State-contributed revenues were 48 percent of the general fund for Sweet Grass County High School in fiscal year 1990-91, up from 34 percent in fiscal year 1989-90. Local property taxes--whether generated by the 22 mill high school foundation levy or by the local permissive and voted levies (39.68 mills in fiscal year 1990-91)--were 59 percent of the general fund revenue base in 1990-91.

Given the funding structure under HB 28, what proportion of the general fund will be paid by state aid versus local taxes in the future will depend on whether additional taxable value per additional student is higher or lower than the currently prevailing ratio. Incremental taxable value per student will affect both the state share of foundation schedule amounts and the state's guaranteed tax base subsidy per mill.

At the beginning of fiscal year 1990-91, Sweet Grass County High School's bonded indebtedness consisted of the following: $32,000 remaining on a 1978 issue of $80,000 to be paid off in 1998, and $1,000,000 remaining on a 1980 issue of $2,005,000 to be paid off in 2000. Annual debt service requirements were about $183,555 in fiscal year 1990-91 (Sweet Grass County High School 1990).

The 1980 bonds were issued by the school district for a new building, and if additional substantial growth in the district were to require major expansion, bonds would have to be issued again, absent other funding. Voters have been supportive of the district's educational mission in recent years (Webb 1990a).

Operating the high school at its current level of expenditure has required the district to go to the people every year for a voted levy, and the margin of passage has been increasing. However, locally authorized levies are only part of the total property tax burden in Montana. Property taxation is increasingly a focus of political attention in the state, and in the future, it is uncertain how the public will react to additional property taxes, for whatever purpose (Webb 1990a; Harkness 1990a).

### 3.14.6 Attitudes, Opinions and Lifestyles

This section provides a general description of lifestyles in Sweet Grass County and describes certain attitudes and opinions of Sweet Grass County residents concerning development and growth. Information for this section was obtained by reviewing secondary data and newspaper articles, participating in the public scoping process, reviewing EIS scoping documents and written public comments, and interviewing a number of Sweet Grass County officials and staff.

This section focuses on those geographic areas most likely to be affected by development of the proposed action and alternatives: the Big Timber area, the lower Main Boulder River Valley from Big Timber to Natural Bridge, and the East Boulder River valley. However, certain of the attitudes and opinions discussed in this section and many elements of lifestyles are common throughout the county.

A number of secondary sources were examined for this analysis. The Sweet Grass County and Big Timber Growth Policy Plans both contain information about local attitudes, opinions and lifestyles. These documents were published in 1978 and refer to more specific documents concerning social conditions in Sweet Grass County, including <u>Rural Social Organization in Sweet Grass County</u>, published by the U.S. Department of Agriculture in 1952 and <u>A Social Impact Assessment of the Vicinity of the Beartooth Face/Stillwater Planning Unit</u>, written by Dr. Raymond L. Gold in 1976. The <u>Baseline Analysis of Social, Economic and Demographic Conditions and Community Services</u> prepared by SPGMR in 1989 contained a discussion of attitudes and values in the county which was drawn in part from a 1981 report on the social life in Sweet Grass County prepared by Western Analysis, Inc.

Although these studies are somewhat dated, many of the social conditions they describe endure to the present as a result of the relatively stable population conditions that have existed over the past two decades and the rural, geographically remote nature of the communities. Information gained from interviews and

the results of a recent survey performed by the Sweet Grass County Planning Staff tend to support this conclusion.

While population levels in Sweet Grass County have been remarkably stable over the last two decades, there has been some exchange of population. Some people have left the county to retire in other places or to pursue job opportunities. Many residents lament the lack of employment opportunities for young people; it is not uncommon for high school graduates to leave the county soon after graduation.

People have also moved into the county. Some of the immigration has been a result of employment opportunities. Professional people have been relocated to Big Timber by the U.S. Forest Service, the hospital, the schools, and more recently by SPGMR. Some people have been attracted to the area for its beauty and the rural quality of life. Of this group, some have left because of the lack of job opportunities and some remain. Sweet Grass County is becoming increasingly popular as a location for retirement and second homes and the county has gained some notoriety for the number of celebrity-owned ranches in the Main Boulder River Valley.

All residents of Sweet Grass County do not share the same values nor do they have similar lifestyles. But it is clear from both the secondary data and recent investigations that most value the natural beauty of the area, the rural western lifestyle, the absence of crowds and congestion, and the scenic vistas unmarred by development.

Two themes are relatively consistent in the secondary data: resistance to change and opposition to extensive development, particularly in rural areas of the county.

The secondary data do not specifically address types of change that would be accepted or resisted; however, this subject has been illuminated somewhat by the interview process. Clearly, most county residents would resist changes that affected those elements of their lifestyle that are most valued. The Western Analysis study identified above listed seven highly valued characteristics of the area. These are:

- The area's natural environment
- The friendliness and openness of the residents
- Quiet, solitude, and privacy
- Good conditions for raising a family
- Slow, relaxed pace of life
- Country living
- The area's schools

At the same time, many residents would welcome changes that bring about more economic opportunity, and changes that bring about diversity in shopping, medical and entertainment amenities, particularly in Big Timber. Changes that resulted in these conditions without damaging highly valued aspects of life in the county would not be resisted by most residents.

A survey conducted in the third quarter of 1990 by the Sweet Grass County Planning Department received a two-to-one negative response rate to the question: Do you favor additional development in your part of the county? While this survey was not administered according to rigorous sampling techniques, the responses corroborate attitudes expressed in many of the secondary sources as well as those expressed in interviews (Sweet Grass County Planning Board 1990).

Although the survey did not isolate responses from Big Timber, it is clear from interviews that development in Big Timber is much more acceptable than development in other parts of the county. For example, there is considerable concern about development in the lower Main Boulder River valley. This concern may result in an organizational response. A citizens' group has launched an initiative to develop new land use regulations in the lower Main Boulder River valley (Langhus 1990b). Residents of the lower Main Boulder River valley are concerned about subdivision of land, increased traffic and potential negative effects on wildlife resources and air and water quality (Woodward Clyde Consultants 1990).

Residents of the East Boulder River Valley are particularly concerned about changes to their way of life that might result from mineral development. Many oppose the use of the existing East Boulder Road for access to mining operations and also oppose development of a new access road that would traverse existing ranch lands. This concern has resulted in a formal letter of opposition. Some East Boulder River Valley residents are also concerned about potential effects on wildlife resources and air and water quality (Woodward Clyde Consultants 1990).

## 3.15 NOISE

Baseline noise measurements were collected in the project area in November 1981, February 1982, and August 1982 (Beak 1983a). The measurements consisted of daytime noise levels ($L_d$), nighttime noise levels ($L_n$), average day-night noise levels ($L_{dn}$), and octave band analyses. Daytime noise levels are defined as those collected between 0700 and 2200 local standard time, and nighttime levels are defined as those collected between 2200 and 0700 local standard time. The average day-night noise levels are derived by logarithmically averaging the $L_d$ and $L_n$ values with a 10 dB penalty added to the nighttime noise levels (EPA 1974). Weekday and weekend $L_d$, $L_n$, and $L_{dn}$ measurements were collected.

Table 3.15-1 presents the ambient noise measurements in the project area. Noise data were collected at four locations (Big Timber Carnegie Library, James Woolsey's Ranch, the East Boulder Campground, and Hunt Cabin). For comparison, the average noise levels recommended by the EPA (1974) for various environmental conditions are presented in Table 3.15-2. The weekday and weekend $L_{dn}$ noise levels measured at the Big Timber Carnegie Library in August 1982 were 59 and 62 dBA, respectively. These noise levels are typical of those found in suburban areas. At the Woolsey Ranch site, weekday and weekend Ldn noise levels were 56 dBA and 58 dBA, respectively. At the East Boulder Campground, the weekday and weekend Ldn noise levels were 52 dBA and 61 dBA, respectively. At the Hunt Cabin, the weekday Ldn noise level was 57 dBA. The weekend Ldn noise levels were not measured at this site. The noise levels recorded at these three East Boulder Valley sites are higher than might be expected for wilderness areas because of the noise generated by the East Boulder River. The noise levels measured in the project area are all well below 70 dBA, which is the level recommended by the EPA to protect against hearing loss. The octave band analyses showed that the noise levels at each recording location were distributed throughout the audible frequency range.

TABLE 3.15-1

AMBIENT NOISE LEVELS (dBA) MEASURED IN THE PROJECT AREA

| Site Number | Description | Primary Noise Source | November | | | | | | August | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weekday | | | Weekend | | | Weekday | | | Weekend | | |
| | | | $L_d$ | $L_n$ | $L_{dn}$[a] | $L_d$ | $L_n$ | $L_{dn}$ | $L_d$ | $L_n$ | $L_{dn}$ | $L_d$ | $L_n$ | $L_{dn}$ |
| 1 | Big Timber Carnegie Library | Town activities and traffic | 57 | --- | --- | --- | --- | --- | 59 | 49 | 59 | 64 | 49 | 62 |
| 2 | James Woolsey's Ranch | Natural background and ranch activities | --- | --- | --- | 50 | --- | --- | 52 | 50 | 56 | 58 | 48 | 58 |
| 3 | East Boulder Campground | Natural background and campers | --- | --- | --- | 49 | --- | --- | 47 | 46 | 52 | 58 | 53 | 61 |
| 4 | Hunt Cabin | Natural background | --- | --- | --- | --- | --- | --- | 50/50[b] | 51 | 57 | 55 | --- | --- |

[a] $L_{dn}$ is the average day/night sound level, defined as:

$$L_{dn} = 10 \text{ Log}_{10} [(15 \times 10^{Ld/10} + 9 \times 10^{((Ln + 10)/10)})/24] \text{ (EPA, 1974)}$$

[b] Two daytime measurements taken on the same day.

Source: Beak Consultants 1982a.

TABLE 3.15-2

## YEARLY AVERAGE[a] EQUIVALENT SOUND LEVELS IDENTIFIED AS REQUISITE TO PROTECT THE PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

| | | INDOOR | | | OUTDOOR | | |
|---|---|---|---|---|---|---|---|
| | Measure | Activity Interference | Hearing Loss Consideration | To Protect Against Both Effects[(b)] | Activity Interference | Hearing Loss Consideration | To Protect Against Both Effects[(b)] |
| Residential With Outside Space and Farm Residences | $L_{dn}$ | 45 | | 45 | 55 | | 55 |
| | $L_{eq(24)}$ | | 70 | | | 70 | |
| Residential With No Outside Space | $L_{dn}$ | 45 | | 45 | | | |
| | $L_{eq(24)}$ | | 70 | | | | |
| Commercial | $L_{eq(24)}$ | (a) | 70 | 70(c) | (a) | 70 | 70(c) |
| Inside Transportation | $L_{eq(24)}$ | (a) | 70 | (a) | | | |
| Industrial | $L_{eq(24)}$[(d)] | (a) | 70 | 70(c) | (a) | 70 | 70(c) |
| Hospitals | $L_{dn}$ | 45 | | 45 | 55 | | 55 |
| | $L_{eq(24)}$ | | 70 | | | 70 | |
| Education | $L_{eq(24)}$[(d)] | 45 | | 45 | 55 | | 55 |
| | $L_{eq(24)}$ | | 70 | | | 70 | |
| Recreational Areas | $L_{eq(24)}$ | (a) | 70 | 70(c) | (a) | 70 | 70(c) |
| Farm Land and General Unpopulated Land | $L_{dn}$ | | | | (a) | 70 | 70(c) |
| | $L_{eq(24)}$ | | | | | | |

Code:

(a) Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult, except in those circumstances where speech communications is a critical activity.
(b) Based on lowest level.
(c) Based only on hearing loss.
(d) An $L_{eq(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than $L_{eq}$ of 60 dB.

Note: Explanation of identified level of hearing loss: The exposure period which results in hearing loss at the identified level is 40 years.

[a] Refers to energy rather than arithmetic averages.
Source: EPA 1974

An analysis of the potential environmental and socioeconomic consequences that would result from implementation of Stillwater PGM Resources' (SPGMR) proposed action or the alternatives is provided in this chapter of the EIS. The effects of facilities construction, operation, and closure are considered by alternative in the analyses for all resources and disciplines. Both direct, indirect, and cumulative impacts are analyzed by resource and discipline in this section.

Impacts to an environmental resource which are solely attributable to an action are termed "direct." They are caused by, and occur at the same time and place as, an action. For instance, vehicular emissions have a direct impact on air quality at the time and place emission occurs. "Indirect" effects are reasonably foreseeable and may be attributable to a particular action, but they occur later in time or farther removed in distance from the action than a direct effect. For instance, new roads for mine development could directly effect recreational opportunity by creating easier access to wilderness areas. An indirect impact of the new roads could be an increase in recreationists.

"Cumulative" impacts are defined by Council on Environmental Quality regulations as "... the impact on the environment which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions... " Section 2.6 of this document identifies reasonably foreseeable actions which have occurred, are occurring, or may occur in the Stillwater Geologic Complex. These "projects of concern" were assessed to determine if they would contribute environmental impacts which should be considered in conjunction with consequences of the East Boulder Mine Project as cumulative impacts. The environmental resources and disciplines which warrant evaluation for each project, as determined by the geographic location and chronologic orientation of a project of concern relative to the East Boulder Mine Project, are listed in Section 2.6 as well. The agencies' best determination of potential cumulative impacts is included in this chapter.

Anticipated impacts for eight alternatives are addressed in this analysis. The eight alternatives under consideration are as follows:

Alternative 1 - No Action
: Represents background conditions including the existence of the approved exploration project.

Alternative 2 - Proposed Action
: Defines the project as proposed including the construction, operation, and closure and reclamation of mine, mill, and ancillary facilities located in three permit areas; the upgrading of existing access road system; and the upgrading of the existing electrical power line and additional power line construction to the mine site.

Alternative 3 - Modified Tailing Impoundment Configuration
: Presents a reconfigured tailing impoundment design which has an outer embankment slope of 2(H):1(V) versus the proposed impoundment design slope of 1.6(H):1(V).

Alternative 4 - Alternative Access Road/Power Line Alignments
: Provides two alternative road/power line alignments to the proposed upgrade of the existing county road.

Alternative 5 - Power Supply Corridor Systems

Provides two alternative electrical power corridor systems to bring power from the existing Montana Power 161 kV to the Duck Creek substation.

Alternative 6 - Water Treatment Alternatives

Presents three different options to reduce degradation of groundwater and surface waters resulting from mining operations. The alternatives, developed to comply with Montana nondegradation rules, include: a complete water treatment system which would nearly eliminate the threat of water quality degradation; a treatment system which would substantially reduce the amount of water degradation; and a third alternative which modifies SPGMR's proposal only sufficiently to assure water quality criteria and drinking water standards are not violated.

Alternative 7 - Proposed Action with Modifications

Presents the proposed action as modified by the inclusion of several measures and requirements designed to mitigate environmental impacts.

Alternative 8 - Twin Production Adits

This alternative replaces the single, 16-foot diameter main access adit with two parallel 13.5-foot diameter adits separated by approximately 25 to 50 feet. As with the proposed action, the twin production adits would be driven approximately 18,550 feet to the targeted ore zone. Because the twin production adits would satisfy the Mine Safety and Health Administration requirement for two exit routes, the Brownlee Creek adit, described in the proposed action, would not be required under this alternative. Alternative 8 contains the same modifications and mitigations incorporated into Alternative 7.

The 1872 Mining Law grants a statutory right to explore, develop, and produce certain minerals on public lands open to mineral entry. It is the agencies' responsibility to ensure that the development of the action does not violate state and federal laws, such as those pertaining to water quality, endangered species, and cultural resources. Cumulative effects from other projects in the area designed to meet the Forest Plan's desired future condition may alone, or in combination with the East Boulder Mine Project implementation, exceed the limits established by these laws. Should this occur, the projects would have to be redesigned, postponed, or dropped from further consideration until the legal limitations can be met.

Some of the analysis presented in this section, particularly those portions addressing impacts to groundwater and surface waters, relies on information from the Stillwater Mine to evaluate potential environmental impacts. During the review period of the draft EIS some commenters disputed the efficacy of this approach, questioning the basis of the agencies belief that the proposed East Boulder Mine would be very similar, in design and certain environmental impacts, to the Stillwater Mine. As a result of the expressed public interest, the following paragraphs have been added which describe the similarities between the two projects.

The Stillwater Mining Company (SMC) is operating an underground platinum and palladium mine near the town of Nye in Stillwater County, Montana. The Stillwater Mine has been operating since 1986, after Department of State Lands (DSL) and the Custer National Forest (CNF) completed an Environmental Impact Statement and subsequently approved the mine operating permit in a Record of Decision.

The mine has approval to operate with a nominal ore production rate averaging about 1,000 tons per day (TPD), approximately half of the 2,000 TPD for which SPGMR wants approval in the East Boulder mine application. However, SMC has recently requested approval to double the Stillwater Mine production to 2,000 TPD. The Department of Health and Environmental Sciences, DSL, and CNF prepared a Draft Environmental Assessment (December 1991) on the impacts of the proposed mine expansion and are now conducting an EIS.

The Stillwater Mine extracts ore from the Stillwater Complex, a 1- to 5-mile-thick by 28-mile-long geologic formation consisting of layers of iron and magnesium-rich igneous rocks. Platinum and palladium, the two major minerals of interest, are located in a zone called the J-M Reef near the bottom of the complex, above chromite-rich zones. Although the geology can vary locally, the J-M Reef can be traced for the full length of the exposed complex, part of the reason why the Stillwater Complex has been recognized as an unique geologic feature of the United States by the Department of Interior. As described in Section 3.5, the proposed East Boulder project would also mine from the J-M Reef in the Stillwater Complex.

The Stillwater Mine uses a cut-and-fill stopping method of mining, the same as that proposed for the East Boulder project. The ore is brought to the surface and upgraded in a flotation mill by crushing, grinding, flotation, and drying to produce a concentrate, which is then shipped to the smelter in Columbus, Montana, for further processing. The proposed East Boulder operations have been designed based on the Stillwater Mine processing facilities.

Tailing from the mill at the Stillwater Mine is placed into an impoundment with a downstream embankment slope of 2:1, although SMC has requested that the embankment slope for the expansion be steepened to 1.6:1. The proposed slope of the East Boulder tailing impoundment is 1.6:1, although Alternative 3 of this EIS evaluates an embankment slope of 2:1. The East Boulder tailing impoundment would be designed to hold approximately 40 percent of the total tailing volume with the remaining 60 percent of coarser fraction to be used as mine backfill, while the Stillwater Mine impoundment holds approximately 35 percent of the total tailing volume with 65 percent being used as mine backfill.

Because the Stillwater Mine and proposed East Boulder Mine would produce very similar ore from the same zone of mineral enrichment, and use the same element extraction processes in the mill, the agencies believe the waste products would be similar. For instance:

- The same blasting mechanisms would be used, either water gels or emulsified ammonium nitrate fuel-oil mixtures. Blasting would probably occur at similar frequencies in both mines. This means the amounts of nitrates and other possible pollutants being carried by mine discharge waters should be similar, although this would also depend heavily on the amount of groundwater produced and discharged by mine operations. The quality of the Stillwater Mine discharge water should therefore be a good indicator of the water quality of the discharge emanating from the proposed East Boulder Mine.

- Because both the tailing characteristics and mill processes are the same for the Stillwater and proposed East Boulder Mine, the quality of the tailing liquid should be comparable.

- Because the ores would be mined from the same zone with similar surrounding rock types, waste rock characteristics should be similar. This allows an analysis of the acid producing capabilities of waste rock from the East Boulder project to rely on data from the Stillwater Mine operations.

Not all of the impacts projected in Chapter Four for the proposed East Boulder project can be directly translated from the Stillwater Mine. Many are site- and area-specific. For instance, cultural resources in the vicinity of the Stillwater Mine may bear no relationship to those found in the East Boulder River Valley, and the impacts upon each cannot be correlated. Other resource evaluations in this EIS, such as those for noise or recreation and wilderness, may consider the impacts of the Stillwater Mine as a relevant data source but the impacts are also dependant on site-specific circumstances. Even the correlations concerning water resources have to be done carefully and in consideration of each site's unique characteristics. Although mine discharge water at the East Boulder Mine Project would be expected to be of very similar quality to that at the Stillwater Mine, the impacts upon the surface waters may not be comparable because of the different qualities and water chemistries of the Stillwater and East Boulder Rivers.

## 4.1 CULTURAL RESOURCES

### 4.1.1 Alternative 1- No Action

Under this alternative, existing mine exploration and development activities would continue under the approved Jackpine Exploration Permit. No impacts to cultural resources were identified in the Jackpine Environmental Assessment. As reported by Mineral Research Center in association with Beak Consultants (1982h), road construction and placement of water quality monitoring wells and the air quality monitoring station were monitored by professional archaeologists. These activities do not appear to have affected any cultural resource properties.

### 4.1.2 Alternative 2 - Proposed Action

Construction. Previously identified cultural resources (which consist of both prehistoric and historic sites) located within and adjacent to the permit areas would be vulnerable to ground disturbing activities, associated with construction of mine facilities. The results of previous cultural resource inventories conducted for SPGMR and others show that cultural resource properties are not distributed evenly throughout the project area. Few properties are located within the steep, timbered hill slopes. Rather, the majority of the prehistoric and historic resources are found on terraces and benches adjacent to the major stream courses within the study area, including the East Boulder River and its tributaries, including Brownlee Creek and Dry Fork.

Direct effects associated with construction related activities could include physical alteration of the cultural resource properties. For example, removal of a building from a historical homestead, or removal of part of the depositional matrix from a buried prehistoric site represent direct effect. Direct visual effect may also result from construction, if construction related activities change the setting of a National Register-eligible property. Although direct physical alteration should be limited to those properties which lie within the permitted areas, visual effect may impact cultural resource properties located outside the permit area boundaries. The types of cultural resource properties most vulnerable to visual effect are historic properties with standing buildings and/or structures, and Native American spiritual use sites.

No cultural resource properties have been located directly within the Placer Basin and Brownlee Creek permit areas. However four prehistoric properties (24SW145, 24SW146, 24SW147, and 24SW148) have been located in the vicinity of the Placer Basin permit area. Mining related activities within the boundary of this permit area would be limited to small scale impacts such as the placement of adits, shafts, raises, and the construction of emergency buildings. Previous cultural resource surveys conducted in the Placer Basin permit area (Lahren 1980a) emphasized intensive inventory of high probability areas; an intensive inventory of all of the area within the boundaries of the corridor was not conducted.

An intensive pedestrian inventory of the East Boulder permit area and adjacent lands resulted in the identification of seven prehistoric cultural resource properties, which lie directly within or adjacent to the East Boulder permit area. Although formal determinations of eligibility have not been made for these properties, the Gallatin National Forest (GNF) is recommending that there are two eligible site complexes; one independently eligible property and one ineligible property. The Boulder Bench complex consists of two areas originally recorded as independent sites: 24SW181 and 24SW233. The Agate Basin complex consists of three areas originally recorded as independent sites: 24SW221, 24SW241, and 24SW243. Within each complex, the individual areas would represent significant and contributing components of the entire complex. In addition, property 24SW300 is recommended as independently eligible for listing in the National Register of Historic Places. The GNF recommends that 24SW182 is ineligible for listing in the National Register of Historic Places.

Additional cultural resource properties are located directly adjacent to or near FS 205 (East Boulder River Road). These include six prehistoric sites (24SW113, 24SW223, 24SW227, 24SW231, 24SW237, and 24SW248) and one historic homestead (24SW258). Widening and/or realignment of the road, and upgrading of the power line could affect these properties. The mitigation treatment of these sites would depend on the kind of effect (direct or in-direct) and level of impact that the sites would be subject to. This determination would be based on the construction design as it is submitted. The treatment/mitigation plan or data recovery plan would be designed by the Forest Service in consultation with the Montana State Historic Preservation Office and the Advisory Council on Historic Preservation (36CFR800).

Indirect effect to cultural resources within or near the project area could result from changing land use patterns, and the influx of people into previously remote areas. Although construction activities would be confined to the permitted areas, more people would be working in the area, and they could recognize the recreational potential of the upper East Boulder River basin. The Main Boulder River already functions as a major recreation corridor, and new and improved access roads into the East Boulder River Valley may result in an increase in the number of people using the area for recreational purposes. Cultural resource properties may be vulnerable to impacts associated with increased recreation use, since they tend to be located in the areas used by modern recreationists for camp sites. Cultural resource sites may be affected either by the intentional collection and destruction of cultural material or by unintentional disturbance such as camping on the surface of unstable land forms which contain buried cultural resources.

Besides the cultural resource properties identified above, additional properties in the vicinity of the permit areas may be vulnerable to indirect effects. Some of these are located on terraces adjacent to Dry Fork, between the confluence of the East Boulder River and Dry Fork, and Moccasin Lake. A rough trail already connects these two points, and in the event of an increase in recreation traffic, impacts to the cultural resource properties located along the trail could increase. Properties located adjacent to the trail include seven prehistoric sites (24SW238, 24SW239, 24SW240, 24SW242, 24SW245, 24SW246, and 24SW262/103), and three historic sites (24SW249, 24SW250 and 24SW252).

Similarly, additional properties could be affected if the old East Boulder River Road were again to become a well used travel corridor. Previously recorded properties located adjacent to or in the vicinity of this old roadway include six prehistoric sites (24SW225, 24SW228, 24SW230, 24SW232, 24SW235, and 24SW236) and two historic homesteads (24SW253 and 24SW254). The National Register eligibility statuses of the properties located along the trail to Moccasin Lake and the old East Boulder River Road have not been determined.

If a property is determined ineligible for listing in the National Register of Historic Places, then project-related activities may usually proceed without further consideration of the property. However, if a property is determined eligible for listing in the National Register of Historic Places, it may either be avoided by project related activities, or if this is not possible, it would be subject to a mitigation plan designed to address the specific values inherent in the property.

Whether or not construction-related activities constitute "no effect," "no adverse effect," or "adverse effect" will be examined through the Section 106 process, currently being undertaken between the GNF and the Montana State Historic Preservation Office.

There are few identifiable short-term or long-term effects associated with the construction phase of this project. National Register-eligible properties located within or adjacent to the permit areas or the access road corridor would either be affected by the project or avoided. If they could not be avoided, then a mitigation plan (usually data recovery), developed in consultation with the federal land managing agency and the Montana State Historic Preservation Office would be implemented to mitigate the adverse impact.

Operations. Although the majority of the effect to cultural resource properties would occur during the construction phase, operation of the mine and mill complex could also produce effects which would impact cultural resource properties. Day-to-day operation and maintenance of the mine would occur within the permitted areas, and would generally not create new areas of disturbance. Rather, operation and maintenance would perpetuate the indirect effects caused by changing recreational use patterns (as discussed in Section 2.1.1).

Changing land use patterns could be considered a long-term effect.

Closure and Reclamation. If the areas of disturbance would be limited to previously impacted areas, there would be few effects associated with closure and reclamation of the mine. Overall, closure of the mine could result in positive effect for cultural resource properties since this action could decrease the number of people traveling through and occupying the area. Closure could result in a reduction of indirect effects to cultural resource properties; however, it is unlikely that the level of human activity in the upper East Boulder River basin would revert to "pre-mine" levels.

### 4.1.3 Alternative 3 - Modified Tailing Impoundment Configuration

The impacts associated with this alternative would be the same as those discussed for Alternative 2.

### 4.1.4 Alternative 4 - Alternative Access Road/Power Line Alignments

Bench Route (R2). The proposed Bench Route would move the portion of the East Boulder River road which lies north of the GNF boundary out of the East Boulder River drainage bottom to the open benches above the west side of the river. However, the portion of the access road south of the GNF boundary would likely be subject to the same level of widening and straightening as proposed under Alternative 2.

The specific corridor of the Bench Route north of the GNF boundary has not been inventoried for cultural resources; therefore, at this time it is difficult to predict the nature of the effect to cultural resource properties, which would be produced by construction of a road in this vicinity. However, the GNF archaeologist has identified at least one rather extensive prehistoric site complex, a tipi ring campsite, which may contain a buried component. (This site has not been assigned a Smithsonian number.) This site is located on private land adjacent to the west edge of the proposed Bench Route. In addition to the tipi ring site, topographic maps of the project area show several irrigation ditches, which may also require documentation as cultural resource properties.

Bench/Valley Route (R4). This alternative route would combine parts of the existing Main Boulder River Road, with a new alignment along the benches above the west side of the East Boulder River. For most of its length it would follow the same alignment of the Bench Route. Based upon the information currently available, the impacts associated with construction of this alternative would be the same as those identified in Section 4.1.2.

### 4.1.5 Alternative 5 - Power Supply Corridor Systems

Construction of either system could impact cultural resource properties which occur in the affected areas. Mitigation would minimize adverse impacts or losses of cultural resources.

### 4.1.6 Alternative 6 - Water Treatment Alternatives

None of the water treatment alternatives considered would cause additional or different impacts to cultural resources than those described under Alternative 2.

### 4.1.7 Alternative 7 - Proposed Action with Modifications

Impacts to cultural resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.2.2) with the exception of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the Department of State Lands (DSL) and GNF in this alternative would effectively reduce or eliminate residual cultural resource impacts remaining after application of the mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

East Boulder Plateau. Breakouts on the East Boulder Plateau (Placer Basin permit area), scheduled to occur throughout the life of the mine, would be approved by DSL and GNF prior to their construction. A cultural resource survey would be conducted prior to approval of any breakouts as deemed necessary by the agencies.

Cultural Resources

The access road corridor and power line corridor would potentially adversely affect sites 24SW113, 24SW223, 24SW227, 24SW231, 24SW237, and 24SW248. The mitigation treatment of these sites would depend on the kind of effect (direct or indirect) and the level of impact that the sites would be subject to. This determination would be based on the construction design as it is submitted. The treatment/mitigation plan or data recovery plan would be designed by the Forest Service in consultation with the Montana State Historic Preservation Office and the Advisory Council on Historic Preservation (36CFR800).

### 4.1.8 Alternative 8 - Twin Production Adits

Construction, operation, and closure of the twin production adits would result in the same impacts to cultural resources as those anticipated for Alternative 7, Proposed Action with Modifications, with one exception. Because the Brownlee Creek adit would not be used under Alternative 8, all potential for impact to cultural resources in the Brownlee Creek permit area would be eliminated.

### 4.1.9 Cumulative Impacts

There are no cumulative impacts to cultural resources because other projects of concern have mitigations, and most are outside the East Boulder Mine Project area of potential impact.

## 4.2 SURFACE WATER RESOURCES

### 4.2.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Road improvements and/or new construction and other earth disturbing activities are expected to add an additional 28 tons of sediment to the East Boulder River over a period of five years. This amount is less than 1 percent of the current estimated yearly sediment load of the East Boulder River as measured at the Dry Fork confluence. This increased amount of sediment is not expected to impact water quality such that it would affect aquatic ecology, nor is it expected to alter the streambed course from aggradation or degradation.

SPGMR was issued an MPDES discharge permit (MT-0026808) in 1988 for discharge of adit water from the Jackpine exploration adit. This permit remains in effect until February 28, 1993. The permit contains provisions for both surface and groundwater (percolation pond) discharge and includes effluent limitations and monitoring requirements. Effluent limits for metals were based on nondegradation; however, nitrate was not subject to the nondegradation rules at the time the permit was issued. Under ARM 16.20.1327, the DHES would require modification of the existing permit to reflect the changes in location and latest nondegradation requirements.

### 4.2.2 Alternative 2 - Proposed Action

The proposed action consists of an underground mine, a surface mine/mill support complex, a tailing retention impoundment, and other secondary facilities.

Construction. Construction would occur in three areas: the East Boulder permit area, the Brownlee Creek permit area, and the Placer Basin permit area. A total of 233 acres would be expected to be disturbed in these areas. Specifically, 200 acres would be disturbed at the East Boulder permit area, 3 acres at the Brownlee Creek permit area, and 30 acres at the Placer Basin permit area. Most of the soil disturbance would come from construction of process facilities. The construction of roads to the East Boulder and Placer Basin permit areas would contribute 6 acres of further disturbance. The removal of existing vegetation and the physical disturbance of the ground surface would result in temporary increases in runoff and erosion during construction periods. Sediment yields in the Stillwater Complex IRA have been estimated using the R1R4 model. The R1R4 model was developed to estimate the effects of timber harvesting, road construction, and fires on erosion export (sediment load) rates.

Sediment yields for the East Boulder River drainage have been estimated during the East Boulder Mine development and the proposed Wright-Gulch timber sale (Story 1990). The cumulative effects of existing roads and clearcuts have currently raised the sediment level in the East Boulder River by about 8 percent above the natural average conditions. Sediment analysis for the mine assumed a total of 233 acres of disturbance acting hydrologically as 5.5 miles of new development and 233 acres of clearcut. Net estimated sediment yield increase in the East Boulder River drainage is expected to be 43 tons/year during construction activities, mostly during the first year, from road construction. This represents a 4 percent increase over pre-exploration baseline sediment loads, which would elevate total cumulative sediment yield in the East Boulder River to 12 percent over natural conditions. Sedimentation should decrease dramatically after the first year to almost pre-mine levels, by the fourth year after construction, because SPGMR has committed to install runoff control devices such as berms and drains to prevent sediment loading to the river. The implementation of erosion control measures during road construction and prompt reclamation of graded soils would reduce the amount of sedimentation and ensure only minor post-construction sedimentation increases.

A more specific R1R4 model has not been developed for the sub-basins in the study area, but no adverse effects on stream channel morphology or downstream beneficial uses are anticipated (Story 1990).

An ongoing program of erosion and sediment control would be in effect. Erosion control would consist of continuous reclamation and stabilization of surface disturbances through the reseeding of cover vegetation. Sedimentation control would also include the use of berms and sediment traps in areas of continuing construction where the potential for downgradient transport of sediments exists.

Construction of the tailing facility would involve the placement of waste rock supplemented with borrow excavated from the interior of the pond. The tailing impoundment would be lined with a low-permeability liner to minimize seepage. Liner installation would require a high degree of quality control and quality assurance to reduce the potential for leaks or tears in the lining materials, and to properly prepare the impoundment subgrade.

A net water loss is expected from evaporation and precipitation pathways. The evaporation rate is approximately 40 inches/year, while the precipitation rate is approximately 20 inches/year.

Waste rock piles at the Stillwater Mine have been shown to have a low sulfur content, and East Boulder mine wastes would be expected to be similar to the Stillwater. Because of the low sulfur content, a lowered pH is not expected, and there should be no or only minor mobilization of metals in the waste rock. Although no adverse impacts to surface water resources are expected from runoff from the waste rock piles,

lithologies with different geochemical compositions which create conditions for acid mine drainage could be encountered during mining.

Nitrates generated from blasting activities may be present in mine discharge water or as adsorbent on waste rock. Because nitrates are difficult to break down or degrade naturally, they may be introduced to groundwater through infiltration at percolation ponds, or to surface waters by runoff or groundwater discharge into the East Boulder River. Nitrates at sufficient concentrations can be biologically toxic and present a threat to surface water ecology. A maximum contaminant level of 10 mg/l has been established by EPA as a suitably protective maximum concentration of nitrate in drinking water. An evaluation of possible loading of nitrates and other compounds into groundwater and surface waters is included in the Operations portion of this section.

Operations. Operations include the removal of ore and waste rock and subsequent transport to the mill. The mill would produce a flotation concentrate which would be shipped to a smelter off site. Mill tailing would be disposed in a lined impoundment located north and west of the mill complex.

There are possible impacts to surface water resources from spills and leaks during operations. Spills and leaks could originate from accidents involving the transportation of personnel, material, and concentrate containers; from the use and storage of flotation reagents and components of blasting compounds (i.e., ammonium nitrate and fuel oil); and from fuel storage tanks.

SPGMR has proposed several measures to manage spills and leaks which occur during operations. Spill control of reagents would be provided by containment structures in the unloading, storage, and mixing areas. Spills or leaks from the fuel storage facilities would be expected to be contained by berms surrounding the tanks. Surface water in the East Boulder River could be impacted by fuel spills that infiltrate into the groundwater and subsequently migrate to the East Boulder River.

During operations, the tailing impoundment could present possible impacts to the East Boulder River if the volume of liquid in the pond were to exceed capacity. The liquid would be comprised of normal operational tailing water and rainfall. All surface runoff upgradient of the tailing dam would be diverted around the impoundment by small ditches, thereby reducing the possibility of overtopping. In addition, impoundment-free board would be sized to prevent overtopping and designed to contain one-half the probable maximum flood.

Liquid from the tailing impoundment could enter the area groundwater by flux through the low-permeability liner or via a tear in the liner material or through an improperly sealed seam. All of these leakage mechanisms are considered likely considering the type of liner material, the large size of the tailing impoundment, and the difficulties in minimizing liner flaws. Impacts to the groundwater, and possibly the East Boulder River through groundwater recharge to the river, would include degradation of existing water quality. Nitrates and other nutrients such as phosphates from milling reagents could be introduced to surface water and groundwater.

Another possible impact from the tailing impoundment would be a dam failure. The dam has been designed so that the peak flow maximum water surface in the East Boulder River would be below the proposed toe elevation and the impoundment would be above the flood plain associated with 1/2 the Probable Maximum Flood (PMF) (See Figure 3.2-3). Failure induced by seismic activity, although considered improbable, is possible.

During construction and operation, mine water would be discharged primarily into percolation ponds or a combination of percolation ponds and sprinkle irrigation within the permit boundary. The estimated discharge to these systems is 737 gallons per minute (gpm). Spray evaporation systems in the tailing impoundment would further reduce the quantity of adit water requiring disposal. Direct surface water discharge to the East Boulder River, under the terms of the MPDES discharge permit (MT-0026808), is a secondary method of disposal proposed by SPGMR. No process or tailing impoundment water would be discharged to surface water.

Discharge of sanitary waste to an approved drainfield, or alternative disposal system, may also impact surface water. The estimated discharge from this source is 10 gpm.

Water pumped into the percolation ponds would exit the ponds in two ways: evaporation and percolation. The evaporation rate would vary primarily as a function of temperature. Evaporation rates in the East Boulder area have an annual estimated rate of 40 inches (National Climate Data Center 1988). Percolation rates based on alluvial transmissivity and permeability values indicate that a long-term increase of streamflow is expected in the East Boulder River. The exact amount of increase that would be expected is unclear because of uncertainty over how much mine water would be produced. Also, it is uncertain where the increase in streamflow would occur from groundwater entering the East Boulder River. However, streamflow increases have been estimated. Using an estimated discharge of 1.5 cubic feet per second (cfs) to the stream from the inflow of the percolation pond, streamflow near the mine site in the East Boulder River would be augmented by less than 0.5 percent under seasonal high flow conditions. Under lower flow conditions, however, streamflow may be augmented by as much as 25 percent. Since these are low flow conditions, this increase will not impact channel morphology.

Considerations of mine water discharge quality and potential impacts to surface water and groundwater are based on information from Stillwater Mine. As described in preceding sections, data from mine water discharge at Stillwater Mine should provide an excellent estimate of the mine discharge water quality for East Boulder Mine, since mining construction and operation would be very similar.

Impacts to surface water quality would result from percolation pond seepage and subsequent discharge, after mixing with groundwater, to the East Boulder River. Direct discharge, under the terms of the MPDES permit, would also impact surface water. Discharge by either method would result in an increase in the concentration of nitrogen species (primarily nitrates) and some metals. Under Montana Administrative Rules, this constitutes degradation of state waters (ARM 16.20.701) and is prohibited, except as allowed by the Board of Health and Environmental Sciences (BHES; 75-5-303, MCA).

SPGMR has petitioned the BHES to increase the ambient concentrations of several parameters (Table 2.3-6b). If approved by BHES, these ambient concentrations would be used by DHES to develop or modify the effluent limits in the surface water discharge permits. The ambient concentrations, determined by BHES, would also be used by the agencies to determine compliance under the water quality monitoring program.

Degradation applies to those parameters with concentrations in the discharge water that are greater than the ambient concentration of the East Boulder River. Dissolved metal concentrations are used to estimate impacts to surface water from percolation pond seepage. Table 4.2.1 presents expected mine discharge water quality, ambient surface and groundwater quality, surface water quality standards, and the results of mixing calculations to address these issues. Table 4.2-1 presents those dissolved parameters which would

degrade surface water if, after mixing with groundwater, they reached the East Boulder River. These parameters include total dissolved solids (TDS), nitrate plus nitrite, ammonia, and manganese.

Several exceedances of water quality standards under low flow conditions are also indicated in Table 4.2-1, but these are also due to the relatively higher ambient groundwater detection limits, not mine discharge.

A similar analysis, based on total recoverable metal concentrations, reveals that direct discharge of adit water would result in degradation for several additional analytes, including iron, copper, nickel, and zinc. Higher concentrations of all constituents are predicted under this scenario, as a result of the lack of initial dilution by groundwater (see Table 4.2-2). Several water quality standards would be violated under the direct discharge.

Direct discharge is evaluated for comparative purposes only, illustrating why SPGMR would not be allowed to discharge directly to the East Boulder River without some treatment. Under federal effluent guidelines (40 CFR 440) used by Montana in the MPDES program, total suspended solids (TSS) would be restricted to an average daily concentration of 20 mg/l or a maximum daily concentration of 30 mg/l. The metal concentrations used in the loading analysis are based on a projected suspended solids concentration of 99 mg/l. SPGMR would be required to provide the degree of treatment necessary to achieve the limits restriction on TSS discharge.

Conventional treatment, as discussed under Alternative 6c, could be applied to the adit water to reduce the suspended solids to acceptable limits. Conventional treatment would proportionally reduce the concentrations of metals. Based on the results of these analyses, the concentrations of iron, copper, nickel, and zinc would be below the ambient concentrations in the East Boulder River and would not cause degradation.

It should be noted that the above analyses of mine water discharge and its potential impact on surface water described above are predicated on assumptions such as projected mine water discharge volume, similarity of the Stillwater Mine water discharge quality to what an East Boulder Mine water discharge quality would be, and flow and quality of the East Boulder River. They represent the agencies' best approximations of the likely conditions should the East Boulder Mine operate, but it is important to understand that variations of any or all of these assumptions could have important implications for the East Boulder River quality.

A potential concern with the percolation ponds is that their effective ability to transfer and filter discharge water into the groundwater would decrease with time. This could occur because of fine sediments and mineral precipitates clogging up pore spaces at the bottom of the ponds. The rate of water transfer could decrease such that mitigating measures to prevent pond overflow would be necessary.

The sanitary drain field (septic system) could introduce several contaminants into the groundwater and subsequently into the East Boulder River. Potential contaminants include coliform bacteria, ammonia, and nutrients, causing increased oxygen demand. Leachate from the drain field would degrade area groundwater.

Table 4.2-1

Estimated Surface Water Quality Resulting from Groundwater Discharge of Mine Water to the East Boulder River

| Parameter | Estimated Concentration in Percolation Ponds (mg/l) (Note 1) | Ambient Groundwater Quality (mg/l) | Estimated Concentration After Mixing in Groundwater (mg/l) (Note 2) | Estimated Concentration After Mixing in Surface Water at Average Flow (mg/l) (Note 3) | Ambient Average Surface Water Concentration (mg/l) (Note 4) | Estimated Concentration After Mixing in Surface Water at Low Flow (mg/l) (Note 5) | Montana Surface Water Quality Standards (mg/l) (Note 6) |
|---|---|---|---|---|---|---|---|
| pH | 7.5 | | | | 7.7 | | 6.5 to 9.0 (SU) |
| Total suspended solids | 99 | | | | < 3 | | |
| Total dissolved solids | 200 | 96 | 167 | 102 | 100 | 122 | 250 |
| Nitrite+Nitrate | 10.6 | 0.1 | 7.3 | 0.3 | < 0.1 | 2.4 | 10.0 |
| Ammonia | 2.3 | < 0.1 | < 1.6 | < 0.2 | < 0.1 | < 0.6 | 1.4 |
| Silver | < 0.00010 | < 0.00500 | < 0.00166 | < 0.00243 | < 0.00246 | < 0.00220 | 0.00012 |
| Arsenic | < 0.0010000 | < 0.0050000 | < 0.0022729 | < 0.0035173 | < 0.0035600 | < 0.0031410 | 0.0000022 |
| Barium | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | 1.00 |
| Cadmium | < 0.000050 | < 0.001000 | < 0.000352 | < 0.001278 | < 0.001310 | < 0.000998 | 0.000950 |
| Chromium | 0.00400 | < 0.02000 | < 0.00909 | < 0.00480 | < 0.00465 | < 0.00610 | 0.01100 |
| Copper | 0.00060 | < 0.01000 | < 0.00359 | < 0.00694 | < 0.00705 | < 0.00592 | 0.01200 |
| Iron | 0.030 | < 0.030 | < 0.030 | < 0.052 | < 0.053 | < 0.045 | 0.300 |
| Mercury | < 0.00020 | < 0.00100 | < 0.00045 | < 0.00083 | < 0.00084 | < 0.00071 | 0.00001 |
| Manganese | 0.020 | < 0.020 | < 0.020 | < 0.012 | < 0.012 | < 0.014 | 0.050 |
| Nickel | < 0.0050 | | < 0.0034 | < 0.0211 | < 0.0217 | < 0.0157 | 0.0810 |
| Lead | 0.00040 | < 0.01000 | < 0.00345 | < 0.02080 | < 0.02140 | < 0.01556 | 0.00240 |
| Zinc | 0.010 | < 0.010 | < 0.010 | < 0.016 | < 0.016 | < 0.014 | 0.267 |

Notes:
1: Dissolved fraction only
2: Based on mixing 737 gpm discharge with 344 gpm groundwater
3: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 70.3 cfs flow in E Boulder R
4: Average of water quality at site EBR 5.2 from Beak, USGS, and Hydrometrics. Total metals.
5: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 5 cfs flow in E Boulder R. Ambient concentrations at low flow assumed same as average ambient.
6: Source Freshwater Chronic Aquatic Life Criteria or Water and Fish Ingestion Criteria in: Quality Criteria for Water 1986 (Gold Book), USEPA, revised 5-1-87. Criteria based on temperature of 5 C, hardness of 80 mg/l, pH of 8.

Table 4.2-2

Estimated Surface Water Quality Resulting From Direct Discharge of Mine Water to the East Boulder River

| Parameter | Estimated Concentration in Mine Discharge (mg/l) (Note 1) | Ambient Average Surface Water Concentration (mg/l) (Note 2) | Estimated Concentration After Mixing in Surface Water at Average Flow (mg/l) (Note 3) | Estimated Concentration After Mixing in Surface Water at Low Flow (mg/l) (Note 4) | Montana Surface Water Quality Standards (mg/l) (Note 5) |
|---|---|---|---|---|---|
| pH | 7.5 | 7.7 | | | 6.5 to 9.0 (SU) |
| Total suspended solids | 99 | < 3 | 5 | 27 | -- |
| Total dissolved solids | 200 | 100 | 102 | 125 | 250 |
| Nitrite+Nitrate | 10.6 | < 0.1 | 0.3 | 2.7 | 10.0 |
| Ammonia | 2.3 | < 0.1 | 0.2 | 0.7 | 1.4 |
| Silver | < 0.00050 | < 0.00246 | < 0.00242 | < 0.00197 | 0.00012 |
| Arsenic | < 0.0010000 | < 0.0035600 | < 0.0035015 | < 0.0029262 | 0.0000022 |
| Barium | 0.01 | < 0.10 | < 0.10 | < 0.08 | 1.00 |
| Cadmium | < 0.000100 | < 0.001310 | < 0.001282 | < 0.001010 | 0.000950 |
| Chromium | 0.01500 | < 0.00465 | < 0.00489 | < 0.00721 | 0.01100 |
| Copper | 0.02800 | < 0.00705 | < 0.00753 | < 0.01224 | 0.01200 |
| Iron | 1.850 | < 0.053 | < 0.094 | < 0.498 | 0.300 |
| Mercury | < 0.00020 | < 0.00084 | < 0.00083 | < 0.00068 | 0.00001 |
| Manganese | 0.030 | < 0.012 | < 0.012 | < 0.016 | 0.050 |
| Nickel | 0.0230 | < 0.0217 | < 0.0217 | < 0.0220 | 0.0810 |
| Lead | 0.00700 | < 0.02140 | < 0.02107 | < 0.01784 | 0.00240 |
| Zinc | 0.020 | < 0.016 | < 0.016 | < 0.017 | 0.267 |

Notes:
1: Dissolved or total, whichever is greater.
2: Based on mixing 737 gpm discharge with 344 gpm groundwater
3: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 70.3 cfs flow in E Boulder R
4: Average of water quality at site EBR 5.2 from Beak, USGS, and Hydrometrics. Total metals.
5: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 5 cfs flow in E Boulder R. Ambient concentrations at low flow assumed same as average ambient.
6: Source Freshwater Chronic Aquatic Life Criteria or Water and Fish Ingestion Criteria in: Quality Criteria for Water 1986 (Gold Book), USEPA, revised 5-1-87. Criteria based on temperature of 5 C, hardness of 80 mg/l, pH of 8.

Septic System. The on-site septic system proposed for the mine employees is expected to be similar to septic systems in use for domestic purposes. The on-site system for the mine would include a septic tank and leach field that remove solids and a portion of organic nitrogen and particulate phosphorus.

In assessing the impact of the on-site septic system on groundwater, the following assumptions were used:

- There would be a total of 600 employees at the mine
- Per capita inflow to the system is 25 gpd
- Nitrogen concentrations entering the tank portion of the system are 35-45 mg/l (Total nitrogen)
- Phosphorous concentrations entering the tank portion of the on-site system are 8 mg/l.

The assessment of the on-site system can be divided into two sections, hydrologic considerations, and chemical considerations. The hydrologic considerations require information on the seasonal high water table, soil types and classification, and percolation test results. Chemical considerations require information on the wastestream and some soil characteristics (e.g. cation exchange capacity).

Hydrology considerations of the proposed septic system require information as stated above. Based on information from Hydrometrics (1990), the groundwater surface is approximately 80 feet below the river water level at a point 200 feet from the bank of the river. Therefore the groundwater table should not impact the drainfield or the tank area.

The soil types in the valley where the on-site system is expected to be placed, consists of well drained with medium to moderately fine textures and subsoil clay accumulations (USDA et al. 1984). This type of soil is ideally suited for optimal drainfield performance.

At present there are no data from a percolation test. It is anticipated that a percolation test would be required for the state and county septic system permits.

Nitrogen enters the septic tank primarily in the form of ammonia. Assuming a mean total nitrogen concentration of 40 mg/l, daily loading to the tank can be calculated by:

$$40 \text{ mg/l} \times 600 \text{ capita} \times 25 \text{ gpd} = 5.1 \text{ lb/day}$$

Assuming that the septic tank removes 60 percent of total nitrogen fraction, the nitrogen leaving the tank is:

$$5 \text{ lb/day} \times 40\% = 2 \text{ lbs/day entering the leachfield}$$

This load to the leachfield is essentially all ammonia. The ammonia fraction is usually adsorbed by minerals in the soil and subsequently oxidized to nitrate. This nitrification is a conversion process not a removal process.

The concentration of nitrogen in water entering the percolation ponds has been estimated at approximately 12.9 mg/l (nitrate/nitrite + ammonia; there is not expected to be any organic nitrogen present). Assuming a flow of 737 gpm entering the percolation ponds, the load to groundwater from the adit water is:

12.9 mg/l x 1.061 MGD (737 gpm) = 114 lbs/day

The total contribution of nitrogen to the groundwater from both sources is approximately 116 lbs/day. The contribution of the septic system is approximately 1.7 percent of the total load to groundwater. This value reflects operations during discharge to the percolation ponds. If land application is used for treatment, the total load to groundwater would be significantly less since plants utilize nitrogen during the growing season.

If the land was exposed to 116 lbs/day (approximately 3,500 lb/month) during the growing season, essentially all of the nitrogen would be removed by the plants. For example, tall fescue can utilize 17.5 lbs/acre/month of nitrogen. If 260 acres were under irrigation, the tall fescue could utilize 4,550 lbs/month.

Normally a shortage of nitrogen or phosphorus limits the growth of algae in streams. The leachfield is the only significant potential source of phosphorus associated with the proposed development. Because of the potential effect on algal growth, the amount of phosphorus which would likely reach the stream was estimated by using the assumptions and procedures normally used by the Department of Health and Environmental Sciences in its review of subdivisions.

The per capita production of phosphorus is about 3.2 pounds per year. Approximately one third of this comes from laundry detergents. This number also assumes full-time use of the system instead of 8 hour shifts; thus, this number should be reduced to 1.4 pounds per year.

Multiplying this number by the number of employees (600) gives a load to the leachfield of 840 pounds of phosphorus per year.

State and county regulations would require a leachfield of about 25,000 square feet for this system. At the leachfield site, the groundwater surface is 80 feet below the land surface. Thus, between the leachfield and the groundwater, there would be about 2 million cubic feet of soil (25,000 x 80). Soils suitable for leachfields will normally adsorb at least 200 pounds of phosphorus per million pounds of soil. Thus, the total adsorptive capacity of this soil is 40,000 pounds (200 ppm x 2 million cubic feet x 100 lbs per cubic foot). In addition, the plume will contact additional soil between the drain field and the surface water. The adsorptive capacity of the soil would remove the phosphorus inputs for 48 years (40,000 pounds capacity/840 pounds per year) without considering other soil contact or other factors such as precipitation, which would also remove phosphorus. Because the adsorptive capacity of the soils below the leachfield exceeds the probable phosphorus load for the projected 30-year life of the mine, there would be no increase in instream phosphorus from a leachfield.

Surface water impacts are not expected at the higher Placer Basin permit area and would be minimal at the Brownlee Creek permit area.

Water Quality Standards and Impacts to Surface Water. The Department of Health and Environmental Sciences (DHES) must ensure that the water quality standards are not violated. While some standards are either cited from other sources or are narrative, most of the water quality standards are numeric. In the discussions which follow, the impacts of granting SPGMR's petition to surface water, with regard to numeric

standards, is discussed. The minimum treatment requirements for discharges to surface water and the effects of the narrative standards are also discussed.

Based on the analyses presented in this section, the concentrations requested by SPGMR, it its Petition for Modification of Quality of Ambient Water, are achievable. While they will cause some degradation, they will not violate applicable numeric water quality standards for surface or groundwater. However, the Department of Health and Environmental Sciences believes that granting the petition level for nitrate in surface water may cause violations of the narrative standard for surface water which prohibits growth of undesirable aquatic life. This section discusses the impacts of granting the petition.

Lead and cadmium were included in the SPGMR petition. The agencies' analysis of the data indicates that the concentration of these parameters in the effluent is less than that of the ambient concentration in the East Boulder River. Therefore, although these two metals have been included in the loading analysis, they are not needed in the petition because the discharge would exceed ambient levels. Before discharging to surface water, SPGMR would be required to provide additional water treatment to achieve an average daily suspended solid concentration of 20 mg/l and a concurrent reduction of metals. This requirement is contained in the water quality standards in ARM 16.20.631 (3), which requires that industrial wastes receive treatment equivalent to the best practicable control technology currently available. This treatment requires that the average discharge concentration of TSS not exceed 20 mg/l.

Total Dissolved Solids (TDS). TDS is a measure of the amount of dissolved salts. The surface water standard is 250 mg/l and applies to chlorides and sulfates. This standard is based primarily on unfavorable physiological and taste concerns, and on the potential for increased corrosion in industrial uses.

The concentration of TDS would increase, from 100 to 102 mg/l at low flow under this alternative (Table 4.2-1). SPGMR has requested an ambient concentration of 200 mg/l. Calcium, sodium, and sulfate are the principle ions affecting TDS concentration. Beneficial uses would not be adversely affected by the projected increase in TDS.

Nitrite and Nitrate. A numeric standard of 10 mg/l for nitrate ($NO_3$) as nitrogen has been established for the protection of water for human consumption. This standard applies to both surface and groundwater. Increases in soluble nitrogen, which occurs primarily as nitrate, can cause increases in the growth of algae. Such growth may cause violations of ARM 16.20.633(1)(e), in the Montana Water Quality Standards, prohibiting discharges which produce undesirable aquatic life. Thus, this standard for surface water maybe more restrictive than the 10 mg/l standard which was established to protect drinking water uses in both surface and groundwater. Because the effects of a given concentration of nitrogen on the growth of algae are not the same in all streams, this concentration must be determined on a site-specific basis.

Using the reasonable worst case assumptions under SPGMR's proposal, nitrate concentration at low flow would increase from 0.1 mg/l at ambient conditions to 2.4 mg/l in the East Boulder River (Table 4.2-1). SPGMR has requested an ambient concentration of 5.0 mg/l in surface water.

The drinking water criterion (10 mg/l) is based on the toxic effects of nitrate to lactating and pregnant women, and infants under the age of 6 months. Young children are the most sensitive due to the presence of nitrate-reducing bacteria in the digestive tract. The projected nitrate concentration in the East Boulder River would not adversely impact use of this water for drinking water purposes.

Nitrogen is a nutrient and, under certain conditions, may stimulate the growth of autotrophic algae in surface water. Generally, algal growth in freshwater is limited by nutrients such as nitrogen and phosphorus. Excessive algal growth may create nuisance conditions such as: undesirable aesthetics, taste, and odors; interference with water treatment systems; blocked water diversion structures; increased production of surface foams; and increased fluctuations of dissolved oxygen (DO) and pH. Under extreme conditions, these fluctuations may result in violation of numeric criteria for DO and pH. These impacts are primarily a result of increases in biomass (mass per area).

Natural algal communities are composed of a complex assemblage of many different algal species, resulting in a high species diversity. Excessive bioavailable nitrogen compounds may favor nitrogen-loving species and result in a less diverse algal community and/or excessive amounts of algae which are aesthetically unpleasant and interfere with fishing and wading.

Excessive algal growth and extreme shifts in community structure could impair beneficial uses of the East Boulder River. There are no state or federal numeric standards for protection of this use. The EPA (1986) has recommended the use of 0.1 mg/l phosphorus and 1.0 mg/l nitrogen in flowing water as maximum guidelines for the protection of these uses. Although nuisance conditions have been observed at much lower concentrations in streams which are slow flowing and relatively warm, or in streams which have relatively constant flows and temperatures, such effects would be limited in the East Boulder system because of the swift current and variations in temperature in this system.

Because of the relatively low concentrations of phosphorus in the East Boulder system, growth of algae caused by increases in the concentration of soluble nitrogen would be limited to relatively moderate changes in the composition of aquatic communities and aesthetic effects.

The Department of Health and Environmental Sciences has used the preceding considerations and several other factors in coming to its judgement as to the maximum concentration of soluble nitrogen that would not result in "undesirable aquatic life" in the East Boulder and other downstream rivers. First of all, the available data indicate that the mean ambient concentration of phosphorus (0.01 mg/l) is well below the recommended concentration of 0.1 mg/l. Secondly, the Department of Health and Environmental Sciences, in its periodic assessments of water quality in Montana, uses 1.0 mg/l as the level above which streams may be impaired. Finally, the effects of nitrate increases on aquatic life in other streams can be used as an indication of what may happen in the East Boulder River. The concentrations of total nitrogen in the Stillwater River below the mine and mill near Nye, Montana, have generally been near 1.0 mg/l, but the status of aquatic life in the stream has not been assessed. The concentration of soluble nitrogen in Libby Creek has been increased to about 3.0 mg/l and has resulted in moderate changes in community composition and standing crop in most of the stream, and relatively major changes in the community composition and standing crop of algae in the immediate area of the discharge. However, because Libby Creek has lower concentrations of phosphorus and other dissolved substances, a coarser substrate, and a more variable flow than the East Boulder River, the results from Libby Creek can not be directly extrapolated to the East Boulder River. Nevertheless, this case also indicates the concentration of soluble nitrogen may be increased without always causing major changes in the stream biota.

Despite the forgoing discussion, it is likely that, at least during certain periods of the growing season, nitrogen is the limiting nutrient in the East Boulder, Boulder, and Yellowstone Rivers. During these periods, any increase in nitrogen will stimulate algal growth. Whether such increases will violate ARM 16.20.633(1)(e) is difficult to assess. A number of complex natural processes act to control algal growth

including temperature, stream gradient, water level fluctuations, and the availability of other nutrients. Other processes act to reduce or control algal biomass, including grazing by aquatic insects and fish.

It is the judgement of the Department of Health and Environmental Sciences, based on current knowledge, that the instream concentration of soluble inorganic nitrogen (NO3 + NO2 + NH3, as N) in the East Boulder River below the mill site should not exceed 1.0 mg/l. This is necessary to prevent the growth of undesirable aquatic life in the East Boulder River and downstream rivers in the basin and, thus, to comply with ARM 16.20.633(1)(e).

Algal biomass and community composition would be monitored using Rapid Bioassessment Protocols (RBP) (EPA 1989), as discussed in Section 2.5.12.2. Annual reports submitted by SPGMR and inspections by the agencies would be used to assure compliance with water quality standards.

Ammonia. Ammonia is toxic to aquatic organisms at relatively low concentrations. The freshwater acute and chronic standards for protection of trout and other cold water species is 20.5 and 1.8 mg/l, respectively, at a pH of 7.0 and a temperature of 10 degrees (C). The projected increase in ambient concentration after mixing with groundwater is 0.1 mg/l, a 100 percent increase above the mean ambient concentration level but well below harmful levels.

The projected increase overestimates the expected ammonia concentration for two reasons. First, most of the baseline observations were below the limits of detection. The detection limit was used in the loading analysis, as a conservative approximation of the true value. Secondly, some ammonia will be adsorbed by soil particles or oxidized to nitrate. Therefore, the ambient surface water concentration of ammonia should only increase after direct discharge.

SPGMR has requested an ammonia concentration of 0.4 mg/l. Beneficial uses would not be adversely impacted by the projected increase of ammonia.

Iron. Iron is the fourth most abundant element on earth and is an essential trace element for the growth of plants and animals. The freshwater criterion for iron is 1.0 mg/l and the recommended maximum level in drinking water is 0.3 mg/l. SPGMR has requested a 0.2 mg/l iron concentration. The mean ambient concentration is 0.03 mg/l and, thus, the concentration of iron would increase. The proposed discharge would not adversely affect human health or aquatic organisms.

Manganese. Manganese is an essential growth nutrient for plants and animals. Manganese is not known to adversely affect aquatic organisms. The surface water human health standard is 0.05 mg/l and is primarily intended to prevent staining and objectionable tastes. SPGMR has requested a surface water concentration of 0.03 mg/l. The loading analysis indicates the manganese concentration would not increase above its present level of .012 mg/l. Human health and aquatic organisms would not be adversely affected.

ARM 16.20.631(3) requires that industrial waste receive, at a minimum, treatment equivalent to the best practicable control technology currently available (BPTCA), as defined in the Code of Federal Regulations (CFR). These requirements are expressed in terms of allowable concentrations in discharges to surface water. The federally-defined limits pertain to both total suspended substances and metals. They do not include limitations on the amount of nitrogen that may be discharged. These requirements can be met by the use of treatments which remove sediment because of the association between sediment and metals, as discussed in Section 4.2.6. The treatment proposed by SPGMR will comply with this requirement.

Water Rights. SPGMR has water rights, subject to prior existing rights, to withdraw approximately 200 gpm of alluvial groundwater during operations, is necessary. This withdrawl represents less than 10 percent of the total stream flow under low flow conditions. Low flow conditions in the East Boulder River have been recorded as 5.2 cfs, taken in March of 1982, just downstream from the confluence of Dry Fork.

Closure and Reclamation. Closure and reclamation activities start with the revegetation efforts during construction and operations. Closure activities specifically include the removal of surface facilities; the sealing of shaft, adit, and ventilation raises on Placer Basin; sealing of the tailing impoundment; and the reclamation of surface disturbances.

Closure of the surface facilities involves the removal of surface structures, followed by revegetation. Possible impacts to surface water resources would be a temporary minimal increase of sedimentation into the East Boulder River and Brownlee Creek due to the surface disturbance. These impacts are expected to be short-term and could be reduced further if reseeding efforts are begun soon after the regrading, during times of low precipitation.

Impacts to surface water resources from other closure activities include the continued use of the percolation ponds to dispose of mine water, which would be expected to continue flowing after cessation of mining activities. The existing water quality of the mine water is not expected to have any long-term impacts on the East Boulder River water quality.

The closure and reclamation of the tailing impoundment would consist of dewatering, grading, and revegetating the site. Because water quality in the tailing facility is expected to generally be good, impacts from dewatering are expected to be low. Since water would be pumped and disposed of by spray evaporation, impacts to surface water resources would depend on the existing water quality. If the effluent does not meet the limits set in a Montana Pollutant Discharge Elimination System (MPDES) permit, a water treatment facility might need to be constructed to meet these limits.

The agencies believe that beneficial uses of groundwater would not be impaired if the BHES were to grant the company's request of 8.0 mg/l in groundwater. The current available data indicates that concentrations of nitrogen above 2.7 mg/l in groundwater may result in nitrogen levels in the surface water above 1.0 mg/l of nitrogen. The level of 2.7 mg/l is based on current data and on conservative estimates regarding the amount of groundwater available for mixing and on the assumption that all nitrogen introduced into groundwater would enter surface water at some point below the mine site. SPGMR would be required to demonstrate that groundwater concentrations of nitrogen will not lead to surface water concentrations exceeding 1.0 mg/l. Plans and specifications for the waste water treatment system would be subject to approval by the agencies.

### 4.2.3 Alternative 3 - Modified Tailing Impoundment Configuration

The modified tailing impoundment is similar to the proposed tailing alignment except that the modified tailing dam face would be less steep (flatter) than the proposed dam face. The less steep nature of the dam would decrease the already remote possibility of a dam failure and subsequent transport of water and tailing into the East Boulder River Valley floor. However, since geotechnical and other investigations have suggested a low probability of dam failure, impacts would be the same for both alternatives.

### 4.2.4 Alternative 4 - Alternative Access Road/Power Line Alignments

Bench Route (R2). The Bench Route (R2) is approximately 60 to 80 feet above the valley floor. Direct impacts on the East Boulder River related to operational use of this route would be reduced given the extra buffer area between the road and the river. However, since the road would cross irrigated farm land, the possibility of erosion and subsequent sediment transport into the river would be increased during the growing (hence, irrigation) season. In addition, use of the Bench Route would not preclude use of the existing road (SG 31) to support exploration activities. The upgrades required for exploration would be the primary concern to river sedimentation, but continued use of the road by residents at least would still result in some erosion and subsequent sedimentation from two roads.

Impacts from spills would also be reduced given the extra buffer area between the river and the road. This extra area, if properly maintained and vegetated, would reduce any impacts that may arise out of the accidental spill of fuels, solvents, etc. However, there would be an increase in short-term environmental impacts to the river (such as channel realignment and sediment loading) relative to the proposed route because additional bridges and sections of road would require upgrading. This is because it has been assumed for the purpose of this EIS that SPGMR will proceed with permitted exploration activities (See Chapters Two and Three). Current plans for exploration require upgrade of SG 31 to provide access for construction equipment and the tunnel boring machine. Approximately 7 bridges will undergo an upgrade. Implementation of alternative road routes would therefore increase the road upgrade requirements over and above those needed on SG 31 for exploration.

Bench/Valley Route (R4). Another road alternative is a combination of the Bench and Valley Routes. This route would involve the construction of an additional bridge across the East Boulder River. Construction of a bridge would result in temporary increases of sediment in the East Boulder River. These impacts would be expected to be short-term in nature.

Since this route is a combination of the proposed and Bench Routes, the impacts to the East Boulder River from this route would also be similar. A long-term impact to the East Boulder River involves the construction of an additional river crossing. The addition of a bridge could potentially change river morphology downstream; however, this would be expected to be of minimal impact.

A complication associated with implementation of either alternative road route is that the existing Valley Route, SG 31, would probably remain useable. It is assumed for the purposes of this evaluation that mine traffic would use an alternative access route if established, but that residents and recreational users of the East Boulder Valley would continue to use SG 31. Therefore, SG 31 would continue to impact the environment at its current operational level while other effects associated with a new route would occur as well.

### 4.2.5 Alternative 5 - Power Supply Corridor Systems

The impacts from the power supply systems described as Alternatives 5A and 5B on surface water resources would depend on the number of streams the power lines would cross. Impacts would include: minor increased sedimentation, and possibly slight changes in stream morphology if power line structures were built adjacent to a stream channel. These impacts could be reduced if power lines used existing roads and bridges; alternative 5A is sited near an existing county road for some of its route. The preliminary routing

information suggests that disturbed acreage would be minimal, and Park Electric has indicated that best management practices would be used to minimize impacts.

### 4.2.6 Alternative 6 - Water Treatment Alternatives

Alternative 6

In an effort to reduce the expected impacts from mine water to surface and groundwater resources in the project area, SPGMR has submitted three alternatives to the mine wastewater problems. The main features of the alternatives are: Alternative 6A would involve the use of a reverse osmosis (R/O) unit; Alternative 6B would involve the use of an Ion Exchange (IX) mechanism to reduce the amount of nitrogen in the effluent; and Alternative 6C would involve only solids removal that could reduce constituents sorbed to particles to lower levels. Section 2.4.4 provides a detailed description of these treatment alternatives. A summary of expected effluent levels and from each treatment process is presented in Tables 4.2-6a through 4.2-6c.

For the purposes of this analysis, it was assumed that all water entering the percolation ponds would enter the East Boulder River and no attenuation of contaminants would occur by the soils matrix. Since the groundwater in this area is the alluvial aquifer for the East Boulder River, the groundwater can be considered part of the surface water system. Therefore, impacts to groundwater resources are assumed to be the same as those for surface water resources. This assumption will ensure a more conservative estimate of pollutant loading to surface water resources since the soil treatment process will not be considered. Wastewater flows would remain approximately the same as for Alternative 2.

Alternative 6A

Alternative 6A includes the use of conventional wastewater treatment systems with specialized processes including the use of a solids filter (sand filtration), a reverse osmosis unit and an option for utilizing a forced evaporation system. The upstream solids removal would be attained by the use of a filter. Solids removal is important to reduce the possibility of the downstream treatment units becoming fouled with these solids.

Based on treatment efficiencies for conventional wastewater, the R/O unit would reduce dissolved chemical constituents by approximately 90 percent from the expected wastestream and up to 97 percent for nitrogen removal. In addition, forced evaporation treatment of the wastestream would evaporate approximately 99 percent of the water. The remaining volume of water would contain elevated levels of metals and nitrates and would be disposed of in the tailings facility.

The water processed by the systems in this alternative would reduce the amount of constituents of concern down to levels approximately equivalent to levels presently found in the East Boulder River. At an untreated effluent concentration of 10.6 mg/l for nitrate and a 97 percent removal efficiency, the treated wastewater would have a nitrate concentration of 0.3 mg/l. Therefore, the impacts to surface water resources from the discharge into the percolation ponds are expected to be negligible.

Table 4.2–6a

Estimated Surface Water Quality Resulting from Groundwater Discharge of Mine Water to the East Boulder River — Treatment Alternative 6A

| Parameter | Estimated Concentration In Mine Discharge (mg/l) (Note 1) | % Removal in Treatment Unit | Estimated Concentration in Treatment Unit Effluent (mg/l) | Ambient Groundwater Quality (mg/l) | Estimated Concentration After Mixing in Groundwater (mg/l) (Note 2) | Estimated Concentration After Mixing in Surface Water at Average Flow (mg/l) (Note 3) | Ambient Average Surface Water Concentration (mg/l) (Note 4) | Estimated Concentration After Mixing in Surface Water at Low Flow (mg/l) (Note 5) | Montana Surface Water Quality Standards (mg/l) (Note 6) |
|---|---|---|---|---|---|---|---|---|---|
| pH | 7.5 | | | | | | 7.7 | | 6.5 to 9.0 (SU) |
| Total suspended solids | 99 | 75 | 25 | | | | < 3 | | |
| Total dissolved solids | 200 | 99 | 2 | 96 | 32 | 98 | 100 | 78 | 250 |
| Nitrite+Nitrate | 10.6 | 97 | 0.3 | 0.1 | 0.2 | 0.1 | < 0.1 | 0.1 | 10.0 |
| Ammonia | 2.3 | 97 | 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.4 |
| Silver | < 0.00010 | 90 | < 0.00001 | < 0.00500 | < 0.00160 | < 0.00243 | < 0.00246 | < 0.00218 | 0.00012 |
| Arsenic | < 0.0010000 | 90 | < 0.0001000 | < 0.0050000 | < 0.0016593 | < 0.0034969 | < 0.0035600 | < 0.0029413 | 0.0000022 |
| Barium | < 0.10 | 90 | < 0.01 | < 0.10 | < 0.04 | < 0.10 | < 0.10 | < 0.08 | 1.00 |
| Cadmium | < 0.000050 | 90 | < 0.000005 | < 0.001000 | < 0.000322 | < 0.001277 | < 0.001310 | < 0.000988 | 0.000950 |
| Chromium | 0.00400 | 90 | 0.00040 | < 0.02000 | < 0.00664 | < 0.00472 | < 0.00465 | < 0.00530 | 0.01100 |
| Copper | 0.00060 | 90 | 0.00006 | < 0.01000 | < 0.00322 | < 0.00692 | < 0.00705 | < 0.00580 | 0.01200 |
| Iron | 0.030 | 90 | 0.003 | < 0.030 | < 0.012 | < 0.051 | < 0.053 | < 0.039 | 0.300 |
| Mercury | < 0.00020 | 90 | < 0.00002 | < 0.00100 | < 0.00033 | < 0.00082 | < 0.00084 | < 0.00067 | 0.00001 |
| Manganese | 0.020 | 90 | 0.002 | < 0.020 | < 0.008 | < 0.011 | < 0.012 | < 0.010 | 0.050 |
| Nickel | < 0.0050 | 90 | < 0.0005 | | < 0.0003 | < 0.0210 | < 0.0217 | < 0.0147 | 0.0810 |
| Lead | 0.00040 | 90 | 0.00004 | < 0.01000 | < 0.00321 | < 0.02080 | < 0.02140 | < 0.01548 | 0.00240 |
| Zinc | 0.010 | 90 | 0.001 | < 0.010 | < 0.004 | < 0.015 | < 0.016 | < 0.012 | 0.267 |

Notes:

1: Dissolved fraction only

2: Based on mixing 737 gpm discharge with 344 gpm groundwater

3: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 70.3 cfs flow in E Boulder R

4: Average of water quality at site EBR 5.2 from Beak, USGS, and Hydrometrics. Total metals.

5: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 5 cfs flow in E Boulder R. Ambient concentrations at low flow assumed same as average ambient.

6: Source Freshwater Chronic Aquatic Life Criteria or Water and Fish Ingestion Criteria in: Quality Criteria for Water 1986 (Gold Book), USEPA, revised 5–1–87. Criteria based on temperature of 5 C, hardness of 80 mg/l, pH of 8.

7: Suspended solids are typically very low in groundwater. Background concentration of 10 mg/l assumed.

8: Background groundwater concentration assumed at detection level of 0.1 mg/l.

Table 4.2-6b

**Estimated Surface Water Quality Resulting from Groundwater Discharge of Mine Water to the East Boulder River — Treatment Alternative 6B**

| Parameter | Estimated Concentration In Mine Discharge (mg/l) (Note 1) | % Removal in Treatment Unit | Estimated Concentration in Treatment Unit Effluent (mg/l) | Ambient Groundwater Quality (mg/l) | Estimated Concentration After Mixing in Groundwater (mg/l) (Note 2) | Estimated Concentration After Mixing in Surface Water at Average Flow (mg/l) (Note 3) | Ambient Average Surface Water Concentration (mg/l) (Note 4) | Estimated Concentration After Mixing in Surface Water at Low Flow (mg/l) (Note 5) | Montana Surface Water Quality Standards (mg/l) (Note 6) |
|---|---|---|---|---|---|---|---|---|---|
| pH | 7.5 | | | | | | 7.7 | | 6.5 to 9.0 (SU) |
| Total suspended solids | 99 | 75 | 25 | | | | < 3 | | -- |
| Total dissolved solids | 200 | 5 | 190 | 96 | 160 | 102 | 100 | 120 | 250 |
| Nitrite+Nitrate | 10.6 | 97 | 0.3 | 0.1 | 0.2 | 0.1 | < 0.1 | 0.1 | 10.0 |
| Ammonia | 2.3 | 90 | 0.2 | < 0.1 | < 0.2 | < 0.1 | < 0.1 | < 0.1 | 1.4 |
| Silver | < 0.00010 | 75 | < 0.00003 | < 0.00500 | < 0.00161 | < 0.00243 | < 0.00246 | < 0.00218 | 0.00012 |
| Arsenic | < 0.0010000 | 75 | < 0.0002500 | < 0.0050000 | < 0.0017616 | < 0.0035003 | < 0.0035600 | < 0.0029746 | 0.0000022 |
| Barium | < 0.10 | 75 | < 0.03 | < 0.10 | < 0.05 | < 0.10 | < 0.10 | < 0.08 | 1.00 |
| Cadmium | < 0.000050 | 75 | < 0.000013 | < 0.001000 | < 0.000327 | < 0.001277 | < 0.001310 | < 0.000990 | 0.000950 |
| Chromium | 0.00400 | 75 | 0.00100 | < 0.02000 | < 0.00705 | < 0.00473 | < 0.00465 | < 0.00543 | 0.01100 |
| Copper | 0.00060 | 75 | 0.00015 | < 0.01000 | < 0.00328 | < 0.00693 | < 0.00705 | < 0.00582 | 0.01200 |
| Iron | 0.030 | 75 | 0.008 | < 0.030 | < 0.015 | < 0.051 | < 0.053 | < 0.040 | 0.300 |
| Mercury | < 0.00020 | 75 | < 0.00005 | < 0.00100 | < 0.00035 | < 0.00082 | < 0.00084 | < 0.00068 | 0.00001 |
| Manganese | 0.020 | 75 | 0.005 | < 0.020 | < 0.010 | < 0.011 | < 0.012 | < 0.011 | 0.050 |
| Nickel | < 0.0050 | 75 | < 0.0013 | | < 0.0009 | < 0.0210 | < 0.0217 | < 0.0149 | 0.0810 |
| Lead | 0.00040 | 75 | 0.00010 | < 0.01000 | < 0.00325 | < 0.02080 | < 0.02140 | < 0.01549 | 0.00240 |
| Zinc | 0.010 | 75 | 0.003 | < 0.010 | < 0.005 | < 0.015 | < 0.016 | < 0.012 | 0.267 |

Notes:
1: Dissolved fraction only
2: Based on mixing 737 gpm discharge with 344 gpm groundwater
3: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 70.3 cfs flow in E Boulder R
4: Average of water quality at site EBR 5.2 from Beak, USGS, and Hydrometrics. Total metals.
5: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 5 cfs flow in E Boulder R. Ambient concentrations at low flow assumed same as average ambient.
6: Source Freshwater Chronic Aquatic Life Criteria or Water and Fish Ingestion Criteria in: Quality Criteria for Water 1986 (Gold Book), USEPA, revised 5-1-87. Criteria based on temperature of 5 C, hardness of 80 mg/l, pH of 8.

Table 4.2-6c

Estimated Surface Water Quality Resulting from Groundwater Discharge of Mine Water to the East Boulder River — Treatment Alternative 6C

| Parameter | Estimated Concentration In Mine Discharge (mg/l) (Note 1) | % Removal in Treatment Unit | Estimated Concentration in Treatment Unit Effluent (mg/l) | Ambient Groundwater Quality (mg/l) | Estimated Concentration After Mixing in Groundwater (mg/l) (Note 2) | Estimated Concentration After Mixing in Surface Water at Average Flow (mg/l) (Note 3) | Ambient Average Surface Water Concentration (mg/l) (Note 4) | Estimated Concentration After Mixing in Surface Water at Low Flow (mg/l) (Note 5) | Montana Surface Water Quality Standards (mg/l) (Note 6) |
|---|---|---|---|---|---|---|---|---|---|
| pH | 7.5 | | | | | | 7.7 | | 6.5 to 9.0 (SU) |
| Total suspended solids | 99 | 75 | 25 | | | | < 3 | | -- |
| Total dissolved solids | 200 | 0 | 200 | 96 | 167 | 102 | 100 | 122 | 250 |
| Nitrite+Nitrate | 10.6 | 0 | 10.6 | 0.1 | 7.3 | 0.3 | < 0.1 | 2.4 | 10.0 |
| Ammonia | 2.3 | 0 | 2.3 | < 0.1 | < 1.6 | < 0.2 | < 0.1 | < 0.6 | 1.4 |
| Silver | < 0.00010 | 75 | < 0.00003 | < 0.00500 | < 0.00161 | < 0.00243 | < 0.00246 | < 0.00218 | 0.00012 |
| Arsenic | < 0.0010000 | 75 | < 0.0002500 | < 0.0050000 | < 0.0017616 | < 0.0035003 | < 0.0035600 | < 0.0029746 | 0.0000022 |
| Barium | < 0.10 | 75 | < 0.03 | < 0.10 | < 0.05 | < 0.10 | < 0.10 | < 0.08 | 1.00 |
| Cadmium | < 0.000050 | 75 | < 0.000013 | < 0.001000 | < 0.000327 | < 0.001277 | < 0.001310 | < 0.000990 | 0.000950 |
| Chromium | 0.00400 | 75 | 0.00100 | < 0.02000 | < 0.00705 | < 0.00473 | < 0.00465 | < 0.00543 | 0.01100 |
| Copper | 0.00060 | 75 | 0.00015 | < 0.01000 | < 0.00328 | < 0.00693 | < 0.00705 | < 0.00582 | 0.01200 |
| Iron | 0.030 | 75 | 0.008 | < 0.030 | < 0.015 | < 0.051 | < 0.053 | < 0.040 | 0.300 |
| Mercury | < 0.00020 | 75 | < 0.00005 | < 0.00100 | < 0.00035 | < 0.00082 | < 0.00084 | < 0.00068 | 0.00001 |
| Manganese | 0.020 | 75 | 0.005 | < 0.020 | < 0.010 | < 0.011 | < 0.012 | < 0.011 | 0.050 |
| Nickel | < 0.0050 | 75 | < 0.0013 | | < 0.0009 | < 0.0210 | < 0.0217 | < 0.0149 | 0.0810 |
| Lead | 0.00040 | 75 | 0.00010 | < 0.01000 | < 0.00325 | < 0.02080 | < 0.02140 | < 0.01549 | 0.00240 |
| Zinc | 0.010 | 75.000 | 0.003 | < 0.010 | < 0.005 | < 0.015 | < 0.016 | < 0.012 | 0.267 |

Notes:

1: Dissolved fraction only

2: Based on mixing 737 gpm discharge with 344 gpm groundwater

3: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 70.3 cfs flow in E Boulder R

4: Average of water quality at site EBR 5.2 from Beak, USGS, and Hydrometrics. Total metals.

5: Based on mixing 737 gpm discharge with 344 gpm groundwater then with 5 cfs flow in E Boulder R. Ambient concentrations at low flow assumed same as average ambient.

6: Source Freshwater Chronic Aquatic Life Criteria or Water and Fish Ingestion Criteria in: Quality Criteria for Water 1986 (Gold Book), USEPA, revised 5-1-87. Criteria based on temperature of 5 C, hardness of 80 mg/l, pH of 8.

The treatment technologies presented in this alternative include the use of an upstream sand filter, ion exchange unit.[1]

Alternative 6B

This alternative is designed to reduce the concentrations of nitrate, metals, and suspended solids from the mine water discharge. While degradation of surface waters would occur under this alternative, the amount of nitrates and metals entering the system would be significantly reduced over the untreated wastestream.

Ion exchange could remove up to approximately 97 percent of the nitrate entering the system. Given the expected concentrations in the wastestream, the concentration is expected to be reduced to approximately 0.3 mg/l. After mixing in groundwater, the concentration is expected to essentially be at ambient surface water concentrations.

Alternative 6C

This alternative is considered a minimum treatment step which would reduce the concentrations of suspended solids, mineralized nitrogen, and metals which tend to sorb on to soil particles. The removal of solids would involve the use of a sand filter or a flocculation agent to reduce the amount of solids entering the percolation ponds. The flocculation agent is usually ferric sulfate which may increase the iron loading to the East Boulder River. An alternative to ferric sulfate is the use of aluminum sulfate; however, availability of aluminum for entry into the East Boulder River has not been evaluated. The sand filtration option is designed to remove suspended solids and adsorbed metals and nitrogen from the wastewater.

Surface water resources would be impacted from the implementation of this alternative by degradation of existing water quality. However, quantification of the impacts would be difficult given: (1) the variability of nutrient and metal sorption on different soil particles and, (2) the variability involved with the partitioning of dissolved and total constituents (i.e., the sand filter will remove the constituents sorbed onto particles but constituents in the dissolved phase would not be reduced). Since, however, soil particles would be removed from the wastestream, impacts would be lower from the implementation of this alternative than Alternative 2.

**4.2.7 Alternative 7 - Proposed Action with Modifications**

Impacts on surface water resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.2.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce or eliminate residual surface water impacts remaining after the application of the mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

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[1]The ion exchange process works on nitrogen only if it is in the form of the nitrate ion ($NO_3^-$). Therefore, the remaining nitrogen (in the form of ammonia and nitrite) must be removed by denitrification (changed to nitrogen gas).

Mine Water Drainage. Due to concern that portal plugs would not be effective in preventing drainage if a large volume of water backs up behind the plug(s), this alternative would require that portal plugs be omitted and drainage water be channeled to the percolation ponds. SPGMR would be required to develop a plan for pond maintenance so that appropriate bonding can be set. Mine drainage and seepage from the impoundment would be monitored for quality and quantity until quality met background conditions or standards determined by BHES. Implementation of these measures would reduce the possibility of low quality water entering the East Boulder River during operations and after closure. Potential impacts to surface water resources from this alternative would be expected to be low provided that the control systems are operated correctly and are upgraded as necessary.

Surface Water Control. Since surface water runoff could enter the tailing impoundment and contribute additional volume that would require treatment, SPGMR would initiate a surface water management plan to keep the runoff from entering the tailing pond. Given the long-term nature of the tailing pond, and the consistent presence of runoff, a long-term management plan (including operation and maintenance) would be required to reduce potential impacts to surface water resources.

East Boulder River. SPGMR has been issued the authority to divert surface water flows from the East Boulder River, and pump up to 200 gpm from the alluvial aquifer of the East Boulder River (See Figure 2.2-1). Use of the full water allocation could greatly reduce East Boulder River flows at certain times of the year.

Under Alternative 7, this appropriation would not be used during "minimum historic low flow conditions." Since water would not be appropriated during low flow conditions, the possibility of the surface flow in the East Boulder River disappearing in that stretch would be eliminated and no long-term or short-term impacts would be expected.

Tailing Impoundment Reclamation. Under Alternative 7, the tailing impoundment reclamation would include rock armor in addition to soil, as described in Section 2.5.5. The use of rock armor would promote retention of soil in place and would reduce the potential of the redistributed soil being transported to the East Boulder River.

Road Mitigations. Roads used during the construction, operation, and closure of the mine have caused concern. Impacts to surface water resources under Alternative 2 would be additional sediment export to the East Boulder River, and the possibility of chemical and petroleum-based spills into the river.

Under Alternative 7, the changes proposed include (with special reference to surface water resources): the establishment of a maintenance agreement (for such things as dust control, runoff, and erosion control), review and approval of road design and modifications, a plan for road reclamation, construction restrictions during wet periods, the restriction of deliveries to daylight hours, and the development of a training plan for the application of dust control chemicals if used. A risk analysis addressing potential impacts of chemical dust control would also be required.

The implementation of these measures would reduce the possible impacts to surface water resources in the study area. Specifically, the establishment of maintenance agreements prior to construction would ensure adequate controls on sedimentation are in place at project initiation. Additionally, if deliveries are restricted to daylight hours, the possibility of spills resulting from accidents during poor visibility would be reduced. The possibility of chemical dust retardants entering the surface water and degrading water quality would be

reduced if a program for training of workers on the proper use (application method, amount of chemical to use, etc.) of dust retardants were established. Vegetation buffers incorporated in SPGMR's plans would also lessen impacts on nearby surface waters.

Waste Rock. Waste rock from the Stillwater Mine has been tested for its acid-forming potential, and SPGMR has suggested that these results are representative of conditions likely to be encountered at the East Boulder Mine. The agencies agree that geologic conditions are likely to be very similar, but feel that a one-time analysis does not necessarily ensure lithologies with acid-forming potential will not be encountered. A more complete monitoring plan would therefore be required under this alternative to reduce the possibility of rocks with acid-forming potential being used for facilities or being introduced unknowingly into storage areas. Corrective measures for preventing this possibility should be incorporated into the monitoring plan.

The impacts from the introduction of rocks with high acid-forming potential on surface water resources could include lowered pH in the East Boulder River, and enhanced mobility of metals in the environment. Because the potential for this occurrence is unknown, this alternative requires institution of a monitoring proposal. Corrective measures would be identified and implemented when necessary, the possibility for water degradation due to leachate from acid-producing rocks would be greatly reduced.

Impoundment Stability. The possibility of, and the impacts associated with, tailing impoundment failure has been addressed previously. Alternative 7 would require additional geotechnical testing under the corner of the impoundment. The installation and operation of test piezometers around the tailing facility toe (outer impoundment perimeter) would monitor groundwater levels. If these test measures indicate an increased or unacceptable probability of the dam failure, appropriate measures would be taken to reduce the possibility of the dam failure.

The development of a contingency plan as requested in Alternative 7 would not reduce the possibility of the dam failing. However the plan would reduce the impacts associated with the dam failure by early identification of mitigating measures to reduce downstream effects on surface water quality.

A summary table of impacts has been prepared showing impacts to surface water resource, if Alternative 7 is chosen (Table 4.2-7). These impacts could be further reduced depending on which (if any) water treatment alternative is chosen by the Board Of Health and Environmental Sciences.

### 4.2.8 Alternative 8 - Twin Production Adits

Potential impacts to surface waters are similar to those described for Alternative 7. The primary difference is that Alternative 8 is expected to generate approximately 10 percent to 20 percent less water during mine operations than the proposed action. This would reduce the total contaminant loading to area surface waters. Also, there would be no potential for water quality impacts to Brownlee Creek and its aquatic resources.

TABLE 4.2-7

SUMMARY OF IMPACTS TO SURFACE WATER RESOURCES
ALTERNATIVE 7 - PROPOSED ACTION WITH MODIFICATIONS

| Source of Impact | Possible Impact | Explanation |
|---|---|---|
| Tailing Pond | Elevated levels of nitrates and some metals in groundwater and possibly surface water | Levels could be high given quality of tailing pond liquid. Pond would, however, be lined with 100 ml HDPE liner. Additionally, monitoring wells would be placed around the impoundment to evaluate changes if a leak occurs. |
| Discharge to Percolation Ponds | Elevated levels of nitrates and some metals in groundwater and possibly surface water | Levels would be elevated over ambient conditions; however, levels would be below surface water standards and would meet drinking water standards. |
| Septic System | Elevated levels of nitrates and phosphorous in groundwater | Levels of nitrogen species and phosphorous species downgradient of the septic system are not expected to be different given the land treatment capabilities of the septic system. Phosphorous could rise if soils could not adequately sorb phosphorous species. Monitoring would be required. |
| Stormwater | | |
| • Waste Rock | Would impact surface water primarily. Waste rock is not expected to be acid-forming, but would be monitored. | Impacts would be minimal if the new stormwater regulations are adhered to. Upgradient water should be routed around any raw material or overburden. Additionally, BMPs would be put in place to assist in controlling sedimentation. |
| • Construction of Roads/Facilities | EPA stormwater regulations require monitoring and use of BMPs to reduce runoff. | See above. |
| Accidental Spills | Surface and groundwater could be impacted. | Impacts from accidental spills would be minimal since Accidental Spill or Discharge Emergency Procedures have been developed. |

### 4.2.9 Cumulative Impacts

The cumulative effects on surface water resources were examined for the East Boulder River watershed. The cumulative effects are based on the following criteria: knowledge of issues and concerns; past experience with similar projects; projects which may require an Environmental Assessment (EA) or Environmental Impact Statement (EIS) and which have the potential to affect the same surface water resources; projects causing earth disturbance which could contribute sediment loading to the same surface water resources; projects having major issues or concerns and; projects required by law, regulation, or direction to be analyzed.

Based on these criteria, effects from two projects, the East Boulder Timber Sale, and the Jackpine Exploration Project, are expected to add some effects to the East Boulder River watershed. The Jackpine Exploration Project is part of the No Action Alternative analysis. The chief concerns related to the cumulative effects of these projects in the watershed are: additional sediment loading to the East Boulder River and some tributaries (from both the timber sale and mining activities); and the possibility of elevated in-stream nitrates and/or metals concentrations (from mining activities).

Since the timber sale and mining activities would tend to increase the amount of surface disturbance in the watershed, the possibility of increased erosion and sedimentation exists. With the increased sedimentation in the river, habitats within the river could be impacted. However, recent studies conducted on Lewis Gulch during the timber harvest indicated that the amount of sediment export to tributaries was quite low (Story 1989). In addition, all mining activities incorporate erosion control measures during construction, operation, and closure. Therefore, the cumulative impacts to surface water resources in the East Boulder River watershed are expected to be low, and no impacts should occur to water users downstream.

## 4.3 GROUNDWATER

### 4.3.1 Alternative 1 - No Action

Alternative 1 is evaluated as a baseline of existing conditions projected into the future in the project area. Under the No Action Alternative, existing exploration and development activities would continue under the approved Jackpine Exploration Permit. During mine exploration and development, groundwater is expected to be encountered when joints, fractures, and shear zones are intersected. This water will be allowed to drain if encountered in a sloping area; however, if water is encountered during mine development, the intersected fissure will be sealed or grouted depending upon the quality and quantity of flow encountered. The water from water-bearing fissures which is encountered and not effectively sealed would be used for supplementing potable water from surface sources or be allowed to drain into the mine discharge handling system depending upon its quality. Concerns about impacts to surface water bodies resulting from mine exploration were addressed in the Jackpine EA. Given the large distance from the exploration tunnels to surface waters, including Camp Lake, the potential for tapping into a connected fracture system and draining the surface waters is considered low.

Potential impacts to groundwater resources include the degradation of groundwater quality by seepage of mine wastewater from the settling and percolation ponds, and/or changes in groundwater availability by intersection of water-bearing fissures as a result of continued development of the Jackpine Exploration Project. It is not possible to quantify the impacts to groundwater associated with continuation of existing development and exploration of the Jackpine Exploration Project. Analysis of water samples from the

Stillwater Mine, thought to be representative of the potential mine water waste from the East Boulder Mine Project, indicates that the water is within acceptable drinking water standards with the exception of suspended solids and possibly nitrates. The settling ponds would reduce the suspended solids content of the water to acceptable levels prior to disposal to the percolation ponds and subsequent seepage into the shallow subsoils. Nitrates, if present, would be adsorbed to some extent by percolation pond bottom sediments and shallow soils; however, nitrates are relatively soluble and could migrate into the groundwater system.

**4.3.2 Alternative 2 - Proposed Action**

Construction. Development activities of the East Boulder Mine would occur in three principal areas; (1) the East Boulder permit area; (2) the Brownlee Creek permit area; and (3) the Placer Basin permit area. Construction activities in these areas would include mine access and ventilation associated with mine development and surface facility construction. Potential impacts to groundwater resources associated with construction would include mine wastewater handling, blasting, earth and personnel transferring equipment, construction of the tailing pond facility, construction of settling and percolation ponds, and construction of the septic tank and sewage drain field system.

During mine exploration and development, groundwater would be expected to be encountered when joints, fractures, and shear zones are intersected. Based on experiences during mine exploration, an average inflow of approximately 500 gpm of mine water would occur over the life of the project. This water would be allowed to drain if encountered in a sloping area. If water is encountered during development of areas such as development headings or adits, the intersected fissure would be sealed or grouted depending upon the quality and quantity of flow encountered. The water from water bearing fissures encountered and not sealed would be used for supplementing potable water from surface sources or allowed to drain into the mine discharge handling system (settling and percolation ponds) depending upon its quality.

Blasting would be conducted as an integral part of the mining operations. Explosives expected to be used include an ammonium nitrate-fuel oil mixture and/or water gels, either in a pumpable slurry or in stick form. Use of the ammonium nitrate-fuel oil mixture type of explosive could result in mine waste water potentially having elevated nitrogen species (nitrates). To date, samples from groundwater sampling at the Stillwater Mine do not exceed allowable nitrates concentrations. Further discussion of nitrates and concentrations of other compounds in mine discharge waters is contained in the discussion under "Operations," and in Section 4.2.2.

Construction of the various support facilities and mine development activities would involve the use of various types of construction and personnel transferring equipment. Associated with this equipment usage are various fluids used to power and lubricate equipment such as gasoline, diesel, and lubricating oils. Tanks would be installed in designated areas for storage of the various fuels. Berms would be constructed around the fuel tanks to contain accidental spills. The probability of a vehicle accident would be increased due to increased traffic and poor weather conditions. The impact related to a vehicle accident would include the spillage or leakage of fuels or lubricants. Impacts would most likely be localized, and easily mitigated by containing and cleaning up the spill and any contaminated soil. This impact would likely be short-term in duration and would not be expected to adversely impact groundwater resources.

Operations. Mine operations include continued mine development, ore and waste rock removal, and milling. The mill would produce a flotation concentrate and mine tailing. The concentrate would be shipped to a smelter off-site and mine tailing would be disposed in a lined tailing impoundment located northwest of the

mill complex. Potential impacts to groundwater resources during operation would include spillage or leakage of fluids, seepage of fluids from the tailing, and groundwater quality degradation from mine wastewater and from the sewage system.

The impact to groundwater from spillage or leakage from equipment used to transport ore, waste rock, and mine personnel would be similar to impacts associated with construction activities. An additional impact to groundwater would be the accidental spillage or leakage of flotation reagents and concentrate resulting from ore processing. Control of concentrate reagents would be provided by containment structures in the unloading, storage, and mixing areas. If leakage or spillage of reagent concentrates should occur, it would most likely be contained within the containment structures and would be easily mitigated. The potential impact to groundwater would not be expected to be high and should be of short duration.

During mine operation, the tailing would be disposed in a lined tailing impoundment. The liquid contained in the impoundment would consist of water contained in the tailing and precipitation which falls in the tailing impoundment. The tailing impoundment could impact groundwater if a leak in the liner occurred, if the impoundment dam failed, if the liquid contained in the impoundment exceeded impoundment capacity, or if liquid seeped through the liner. The potential for degradation of groundwater resources would be expected to be high since single liners may leak, either due to tears during placement, liquid flux through the liner material, or improper seam seals. However, the impact to groundwater quality would be considered minor because the quality of water contained within the impoundment would be expected to be generally good. The impoundment is designed to minimize the potential for release of the contents, and a groundwater monitoring system consisting of regular sampling and analysis would be in place to monitor the effects of the tailing impoundment on groundwater resources.

The tailing impoundment would be lined with an impervious 100-mil high density polyethylene (HDPE) liner to minimize seepage into shallow subsurface soils and groundwater. Although the HDPE would degrade through time, the lining material would be expected to maintain functionality well past the mine lifetime. Seepage rates for the tailing impoundment at the East Boulder mine were estimated by IECO using the equation:

$$Q = K_{avg}\, i\, a \qquad (1)$$

where:

- $Q$ = seepage from impoundment
- $K_{avg}$ = average permeability of liner/tailing
- $i$ = hydraulic gradient (1.0)
- $a$ = pond surface area

$K_{avg}$ can be estimated by using the equation:

$$K_{avg} = \frac{L_1 + L_2}{L_1/K_1 + L_2/K_2}$$

where:

$K_{avg}$ = average permeability
$K_1$ = permeability of tailing
$K_2$ = permeability of liner
$L_1$ = thickness of tailing
$L_2$ = thickness of liner

By estimating the depth of tailing and the associated surface area maximum seepage rates were calculated.

| Estimated Seepage gallons/min | Year | Avg. Tailing Thickness (ft) | Equivalent Permeability (cm/sec) | Surface Area (acre) |
|---|---|---|---|---|
| 0.01 | 3 | 17 | $2.1 \times 10^{9}$ | 9 |
| 0.08 | 8 | 20 | $2.5 \times 10^{-9}$ | 47 |
| 0.17 | 13 | 33 | $4.1 \times 10^{-9}$ | 62 |
| 0.20 | 20 | 47 | $5.9 \times 10^{-9}$ | 71 |
| 0.39 | 28 | 61 | $7.6 \times 10^{-9}$ | 80 |

This estimate of 0.39 gal/min is considered a maximum seepage rate due to the presence of a hydraulic head over the liner and area include surface area exposed to the "slimes." At the end of the impoundment life when the pond area and depth are greatest, the maximum seepage rate is estimated to be 0.4 gpm.

The quality of the tailing water would be expected to be similar to that at the Stillwater Mine. Results of an analysis of this water indicated that the water is generally within drinking water standards with the exception of sulfate, nitrate, and total dissolved solids (TDS). Seepage of tailing liquid into the groundwater would result in minor degradation of the existing groundwater quality. A variance from the Montana nondegradation rules would be required to allow SPGMR to operate the tailing facility in this fashion. As noted in the surface water impacts discussion, phosphate-containing reagents present in the tailing liquid could also degrade area groundwater, but the impact would be considered of minor magnitude. Should phosphate and/or nutrient loading be of sufficient magnitude that it reaches the East Boulder River, the impacts could be more severe, since changes in the nutrient balance could affect aquatic ecology and oxygen availability.

Design and location of the tailing impoundment are intended to minimize the potential for dam failure. The toe of the dam would be located well above the elevation of the maximum peak flow in the East Boulder River and out of the flood plain associated with the ½ PMF.

The tailing impoundment facility is designed to divert potential inflow from surface runoff around the impoundment, thus reducing the potential for exceeding design capacity due to precipitation. In addition. the tailing impoundment is designed to contain one-half of the probable maximum flood. Also. reclaim water from the tailing impoundment would be recycled for use in the milling process.

Mine wastewater would be handled in much the same manner during mine operation as it would be during construction and development activities. A high potential exists for mine wastewater to cause elevated levels of nitrates and metals in groundwater, thereby violating Montana nondegradation rules. Table 4.3-1 shows the general quality of the groundwater in the area of the East Boulder Mine. An approximation of the extent of degradation which would occur to groundwater, based on the assumed water quality presented in Table 4.3-1, is presented in Table 4.2-1; an explanation of the approximation follows.

Dissolved metals concentrations and other parameters are shown on Table 4.3-1 (2nd column) and compared to concentrations in ambient groundwater as determined by averaging four samples from well WW-1. Concentrations of TDS, nitrates ($NO_3$) + nitrites ($NO_2$) as total nitrogen (nitrate-only data is not available), and ammonia ($NH_3$) in Stillwater Mine discharge water are above concentrations in area groundwater. Discharge would therefore violate Montana's nondegradation rules. Concentrations of iron (Fe) and manganese (Mn) are assumed to be equal to ambient groundwater quality, although detection limits prohibit a true determination. Lead (Pb) and chromium (Cr) are well below existing groundwater quality.

Although none of the metals or compounds shown in the mine discharge water exceed current or proposed drinking water standards (columns 4 and 5, respectively), a mixing calculation was conducted by Hydrometrics (1991) to determine the net quality of the groundwater after mine water discharge to the aquifer. The mixing calculation was done based on an assumed 737 gpm mine water discharge with 344 gpm of ambient groundwater, which can represent the mixing that would occur if discharge were through the proposed percolation pond.

The calculations conducted show that discharge of mine water to the groundwater system would violate Montana nondegradation rules. However, the extent of degradation would not be such that drinking water standards for any compounds assessed would be violated, and the groundwater would remain acceptable for drinking water purposes.

The agencies believe that beneficial uses of groundwater would not be impaired if the BHES were to grant the company's request of 8.0 mg/l in groundwater. The current available data indicates that concentrations of nitrogen above 2.7 mg/l in groundwater may result in nitrogen levels in the surface water above 1.0 mg/l of nitrogen. The level of 2.7 mg/l is based on conservative estimates regarding the amount of groundwater available for mixing. All nitrogen introduced into groundwater would enter surface water at some point below the mine site. SPGMR would be required to submit final plans and specifications for water treatment facilities to the agencies, demonstrating how the concentrations authorized by the BHES would be achieved in both surface and groundwater.

Metals and nitrate concentrations in groundwater are not expected to exceed federal or state drinking water standards.

TABLE 4.3-1

AMBIENT GROUNDWATER QUALITY[a]

| Parameter | Ambient Ground Water Water Quality (mg/l) |
|---|---|
| TDS | 96 |
| NO3+NO2 | 0.083 |
| Silver | 0.005* |
| Arsenic | 0.005* |
| Barium | 0.1* |
| Beryllium | 0.005* |
| Cadmium | 0.001* |
| Chromium | 0.02* |
| Copper | 0.01* |
| Iron | 0.03* |
| Mercury | 0.001* |
| Manganese | 0.02* |
| Lead | 0.01* |
| Selenium | 0.005* |
| Zinc | 0.01* |

[a]Average of 4 samples collected from well WW-1. Values shown are for dissolved metals.

*All measured values are less than the analytical detection limit. Value shown is the detection limit.

Source: Hydrometrics 1991.

The on-site wastewater disposal system (septic system) has been designed to treat approximately 15,000 gallons per day. The associated drain field would be approximately 40,000 square feet when installed. The on-site system would contribute coliform bacteria, nitrogen species, and phosphorus species to the alluvial aquifer. Based on septic system literature, phosphorus species are anticipated to be low in concentration. The amount of coliform bacteria in groundwater would depend on several factors and is difficult to estimate. Nitrogen species (organic nitrogen, ammonia, nitrite, and nitrates) entering the groundwater system are also difficult to estimate and would vary as a function of the amount of personnel using the facilities located at the site. However, total nitrogen loading would be expected to increase due to input from the septic system, and this impact would further degrade groundwater in the vicinity of the mine and mill.Nitrogen species are not easily attenuated and persist in the environment. Given the limited domestic use of groundwater at the East Boulder adit site, the effects overall would be limited. However, nitrogen species could migrate downgradient into other potential potable water sources and into the East Boulder River. An analysis of this possibility and the resulting groundwater and surface water quality is included in Section 4.2.2.

The implementation of a groundwater monitoring program, that includes upgradient and downgradient monitoring wells around the drain field, and a monitoring program of private potable wells downgradient would indicate the effectiveness of the on-site system. Additionally, the implementation of a contingency plan to handle excess nitrates or other compounds in groundwater would help alleviate groundwater contamination problems in a timely manner. For instance, a pump-back system could be installed to extract groundwater near the septic drain field and permit boundary and feed water to a treatment or irrigation system. This would prevent contaminated groundwater from migrating outside the permit area. Further discussion of this potential is included in the discussion of Alternative 6 options, and an analysis of the benefits and drawbacks of Alternative 6 is found in Section 4.2.6.

Closure and Reclamation. Activities associated with closure and reclamation would begin with reclamation efforts during construction and operation of the East Boulder Mine. Closure and reclamation would include the removal of surface facilities, sealing of mine workings (shafts, adits, and ventilation raises on the East Boulder Plateau), and sealing of the tailing impoundment. The East Boulder adit and the settlement and percolation ponds would remain intact as part of closure activity. Over the life span of the mine, some areas of surface disturbance would be revegetated as part of the East Boulder Mine Project.

Surface facilities which are determined to have no post-mining benefit would be dismantled and removed, and the area revegetated as described in the Plan of Operations, February 1990, as amended. No impacts to groundwater resources are likely to occur as a result of closure and reclamation of the various surface facilities.

Closure of the various mine workings would involve dismantlement and reclaiming of the surface disturbance and sealing the shafts and ventilation raises. Sealing the shafts and raises would be completed by constructing a bulkhead below the collar and pouring a reinforced concrete plug. Waste rock would be placed in the collar and covered with soil. Adits which have no beneficial use would be plugged with waste rock. If the agencies determine an adit has a beneficial use in the future, it would be secured with heavy steel mesh locking doors anchored to the rock walls. The portal pads would be reclaimed to near pre-mining conditions. The East Boulder adit would remain open, but secured with steel doors to allow for continued drainage of mine workings into the percolation ponds.

Potential impacts to groundwater resources from closure of the mine workings would be a result of continued drainage of mine water into the percolation ponds. The impact to groundwater resources would continue after reclamation due to the mine drainage. Quality of mine water would be expected to improve following mine closure since sediment loads would be reduced. Nitrate levels would go down with completion of blasting activity. Discharge to the percolation pond system would require a permit by the MDHES Water Quality Bureau.

The tailing impoundment would be reclaimed by dewatering, grading, and revegetating the site once the tailing facility has reached its maximum holding capacity. The only potential impact to groundwater resulting from closure and reclamation of the tailing impoundment would be the introduction of tailing water into the groundwater system. This is not expected to occur since the tailing water would be spray evaporated during dewatering activities. If additional water is encountered during tailing impoundment reclamation, which cannot be handled by spray evaporation, a water treatment plant facility would be considered to ensure the quality of the effluent would meet the limits set in a MPDES permit.

### 4.3.3 Alternative 3 - Modified Tailing Impoundment Configuration

This alternative is similar to Alternative 2, except that the tailing impoundment is modified such that the downstream face of the tailing dam would be less steep, having a slope of approximately 2(H):1(V).

Modification of the tailing impoundment would not alter the potential impacts to groundwater as discussed under Alternative 2.

### 4.3.4 Alternative 4 - Access Roads

The use of existing roads, construction of new roads, and installation of additional power lines are expected to have no impact on groundwater resources.

### 4.3.5 Alternative 5 - Power Supply Corridor Systems

The installation of various power supply systems is expected to have no impact on groundwater resources.

### 4.3.6 Alternative 6 - Water Treatment Alternatives

Impacts on groundwater resources from implementation of any of the three subalternatives under Alternative 6 would be expected to be those described in Section 4.2.6.

### 4.3.7 Alternative 7 - Proposed Action with Modifications

Impacts on groundwater resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.3.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce or eliminate residual groundwater impacts remaining after the application of the mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Groundwater Contamination. The primary concern when considering possible groundwater contamination is the operation of the percolation ponds and the drain field of the septic system. The use of the percolation ponds could impact groundwater quality if the disposed water does not have acceptable water quality. The implementation of a groundwater monitoring network would readily indicate potential contamination entering the alluvial aquifer. Additionally, an approximation of nitrate and chemical loading has been undertaken using a calculation based on expected mine water discharge, discharge water quality, seepage through percolation ponds and the impoundment, and other factors. These calculations are shown in Tables 4.2-3 in Section 4.2.2. Although some groundwater degradation would be expected to occur over existing water quality, no drinking water standards would be violated.

Impoundment Stability. Under Alternative 7, test piezometers would be installed to monitor groundwater levels. If groundwater levels increase and pose a threat to the stability of the tailing dam, then appropriate geotechnical remedial measures would be implemented. These geotechnical measures could include groundwater drains or slurry walls. If appropriate measures are taken, the groundwater conditions would have minimal impact on tailing dam stability.

### 4.3.8 Alternative 8 - Twin Production Adits

Development activities of the East Boulder Mine would occur in two principal areas: the East Boulder permit area and the Placer Basin permit area. During mine exploration and development, groundwater would be expected to be encountered when joints, fractures, and shear zones are intersected. Based on experiences during mine exploration, an average groundwater inflow for the life of the mine was projected for Alternative 7, which ranged from approximately 384 gpm to 472 gpm. Hydrometrics (1991) has estimated that inflow for Alternative 8 would be approximately 10% to 20% less than the Alternative 7 estimates due to the elimination of the Brownlee Creek adit.

The calculations conducted show that discharge of mine water to the groundwater system would violate Montana nondegradation rules. However, the extent of degradation would not be such that drinking water standards for any compounds assessed would be violated, and the groundwater would remain acceptable for drinking water purposes. This conclusion is also considered relevant to Alternative 8, which would result in less overall degradation to groundwater because of the reduction in mine water discharge and contaminant loading to the aquifer (see discussion in Section 4.2.2).

As with the surface water quality impacts analysis, impacts to groundwater quality are based on projected mine water discharge volume and quality and other assumptions which, if different during mining operations, could have important implications for groundwater quality and useability.

### 4.3.9 Cumulative Impacts

There are no known projects which would contribute additional environmental impacts on the area groundwater. Evaluation of the cumulative impacts from implementation of the East Boulder Mine Project to groundwater resources are based on the following criteria: knowledge of current issues and concerns; past experience with similar projects; and projects which could impact the proposed project. This evaluation did not indicate the presence of any major cumulative impacts to groundwater resources in addition to those discussed previously as related to the proposed project implementation. However, all projects considered now or in the future must meet MPDES standards and comply with nondegradation policies of the state of Montana until or unless a variance from compliance is issued by the Montana BHES.

## 4.4 SOILS

Environmental consequences on soils should be minor and short-term under most alternatives, provided appropriate actions and methods for construction, operations, and closure/reclamation methods are employed. Many soil impacts are directly related to the amount of area disturbed. The greatest impacts result from the removal and stockpiling of soil ahead of facilities construction and the compaction of soils during construction and operations. Soil excavation, stockpiling, and compaction may cause a small long-term decrease in soil productivity due to the loss of organic matter and soil microorganisms, both of which affect nutrient availability. Temporary impacts of accelerated erosion and downgradient sedimentation would result from soil disturbance near portals, adits, roadways, stream-crossings, and power corridors. Only minor and temporary impacts on water quality from reconstruction of stream-crossings should occur as a result of soil erosion and sedimentation.

Soils may also be impacted by the introduction of contaminants by way of spills or leaks during mine construction or operations. Potential sources of contaminants include spills/leaks from 1) vehicular accidents involving the transportation of personnel, fuels/lubricants/solvents, other construction/operations materials, and produced ore concentrate; 2) on-site use and storage of flotation reagents and blasting materials; and 3) on-site fuel storage tanks.

### 4.4.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Major sources of soil impacts include construction of the exploration adit, percolation ponds, access road, and support facilities. Approximately 30 acres will be disturbed during the two-year exploration project.

A small amount of soil from ponds and facility areas will be removed and stockpiled for reclamation. Stockpiling will be for a two-year project period. Stockpiled soil will be subject to wind and water erosion for relatively short periods during manipulation and revegetation. On most sites only slight decreases in long-term soil productivity will occur. This effect results in slightly less productive vegetative growth. This action should not preclude revegetation to pre-mine native species.

Activities that remove vegetation and the surface organic litter layer expose soil to erosion by wind and water. Buildings and related facilities occupy small areas of a few acres. Approximately 1.0 mile of new road has been constructed.

Seven existing stream crossings will be rebuilt to handle heavier loads. This rebuilding requires direct manipulation of streambank soils and creates short-term minor sedimentation impacts. Soil near crossings will be exposed to erosion and stream sedimentation until vegetation is reestablished and erosion control features are installed. Long-term impacts of stream crossing will be dependent on road use and maintenance of erosion/sedimentation control features.

### 4.4.2 Alternative 2 - Proposed Action

Impacts to soils would result from the construction of portals, percolation ponds, tailing impoundment, roads, powerlines, and support facilities. Approximately 203 additional acres would be disturbed in this alternative, for a total of 233 disturbed acres when considered in addition to existing soil disturbance (see Alternative 1).

Soil from areas to be disturbed would be removed and stockpiled for reclamation from approximately 200 acres. Original estimates suggested that only two inches of soil was available for redistribution over all disturbed areas based on a total of 68,000 cubic yards at the East Boulder permit area and 10 cubic yards at the Placer Basin permit area. No suitable soil was available for stockpiling at Brownlee Creek.

A recent, more detailed soil inventory revealed that the East Boulder permit area has from 0 to 60 inches of soil suitable for stockpiling and reclamation (Noel and Houlton 1991). Based on projected soil replacement volumes committed to by SPGMR in the application, approximately 28 inches of soil would be redistributed on 158 acres at the tailing impoundment and mill and mine support complex. Stockpiling would be for approximately a 25-year period. Stockpiled soil would be subject to wind and water erosion during the short periods of manipulation and revegetation. Stockpiles would have 2(H):1(V) sideslopes. Stockpile surfaces would have at least two-percent slopes. A slight decrease in long-term soil productivity would occur causing slightly less productive vegetative growth during initial reclamation. Soil removal and storage should not preclude revegetation to pre-mine native plant species.

Seven existing stream crossings would be rebuilt to handle heavier loads. This rebuilding would require direct manipulation of streambank soils and create short-term minor sedimentation impacts. Soil near crossings would be exposed to erosion and stream sedimentation until vegetation is reestablished and erosion control features are installed. Long-term impacts of stream crossings would be dependent on road use and maintenance. Sediment loads resulting from such erosion are discussed under Section 4.2, Surface Water Resources.

Approximately 2.6 miles of new road would be constructed, and 26 miles of existing road would be reconstructed. Approximately 2.6 miles of new powerline would be constructed, and 12 to 15 miles of existing powerline upgrade would occur. Road and powerline construction would create the opportunity for soil erosion until vegetation is reestablished and erosion control features are installed.

Potential spills or leaks of contaminants could adversely affect the ability of affected soils to support protective vegetative cover and productivity. However, such events and their impact should be localized and short-term in duration; SPGMR is committed to the immediate containment and clean-up of all spills or leaks as required. The East Boulder Project Plan of Development (SPGMR 1990) describes containment structures/berms to be constructed and maintained around reagent and fuel-related facilities, and provides an Emergency Response Plan which addresses accidental spill or discharge emergency procedures.

### 4.4.3 Alternative 3 - Modified Tailing Impoundment Configuration

The modified configuration is almost identical to the Alternative 2 configuration, except that the slope of the tailing pond embankment sections would be less steep (2(H):1(V) instead of 1.6(H):1(V)). Reclamation may be enhanced on the less steep slope. Since the impoundment's outside perimeter is not different from that proposed by SPGMR, impacts would be similar. However, the less steep embankment slope would require more material for construction.

### 4.4.4 Alternative 4 - Alternative Access Roads and Power Line Alignments

Bench Route (R2). This route would increase the length of new road from 2.6 to 6.5 miles exposing additional soil to erosion. The number of stream crossings requiring construction or reconstruction would be 7.

The Bench Route has a high potential for impacts from landslides/slumps due to soil, groundwater, and slope conditions. In most areas, this road location would be above a steep slope (terrace escarpment) and below wetland areas which contribute water. Several active slumps occur on adjacent steep slopes. In Section 16, this route would pass just above an active landslide and just below an irrigation ditch. Conditions commonly associated with landslide and slump activity include fine soil texture, steep slopes, and a water source. Other impacts on soil may occur from drainage activities associated with road construction.

Bench/Valley Route (R4). In this case, the total length of the new road would be 7 miles instead of 6.5 for the Bench Route. The additional number of stream crossings would be 8 instead of 7. This route would also pass directly above the active landslide in Section 16.

### 4.4.5 Alternative 5 - Power Supply Corridor Systems

Power supply system construction would increase potential for soil erosion and soil compaction. The locations of these routes would not result in different impacts on soils.

### 4.4.6 Alternative 6 - Water Treatment Alternatives

Implementation of one of the water treatment alternatives would have no additional impacts beyond those described for Alternative 2 in Section 4.4.2.

### 4.4.7 Alternative 7 - Proposed Action with Modifications

Impacts on soils from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.4.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce or eliminate residual soil impacts remaining after the application of the mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Tailing Impoundment Reclamation. Use of a rock armor as a surface cover over 50 percent of the tailing impoundment outslope and the reduction of a maximum slope length to 150 feet would reduce soil loss due to erosion, sediment deposition on lands below the tailing dam, and potential stream sedimentation.

Road Mitigations. Restrictions placed by the agencies on the construction of unimproved roads during wet periods to reduce compaction, rutting, and subsequent erosion would reduce such impacts and minimize efforts necessary to reclaim/revegetate the disturbed area. Adherence to a road maintenance agreement which requires dust control and water erosion controls would reduce soil loss from road surfaces and shoulders and potential soil deposition off the road on lands or in streams. A commitment to reclaim roads no longer needed during operations and adherence to an approved reclamation plan for roads would reduce erosion and restore productivity of the disturbed lands.

Soils. To ensure the availability of suitable soil materials (1 percent or more organic matter content, 50 percent or less coarse fragment content) for use in reclamation, the agencies would require that all available, suitable soil be salvaged and stockpiled ahead of facilities construction. This mandate to ensure adequate volumes of suitable soil be salvaged would enhance the probability for successful reclamation/revegetation of disturbed lands. The agencies' requirement to reduce slopes of soil stockpiles to 2(H):1(V) would reduce soil erosion and promote surface stability and the establishment of protective vegetation.

East Boulder Plateau. Breakouts on the East Boulder Plateau (Placer Basin permit area), scheduled to occur throughout the life of the mine, would be approved by DSL and GNF prior to their construction. A soil survey of each breakout area would be conducted prior to approval of the breakout as deemed necessary by the agencies.

### 4.4.8 Alternative 8 - Twin Production Adits

Impacts are expected to be similar to those described for Alternative 7 (Section 4.4.7) with the exception that additional soil disturbance would occur from development of two adits as opposed to one, and no soil disturbance would occur in the Brownlee Creek permit area. Impacts related to Alternative 8 should also be minor and short-term. Soil impacts are directly related to the amount of area disturbed. The greatest impacts result from removal and stockpiling soil from settling pond and facilities areas. This complete soil disturbance may cause a small long-term decrease in soil productivity. Temporary impacts would result from soil disturbance near portals, adits, roadways, stream-crossings, and power corridors. Only minor and temporary impacts on water quality should occur as a result of soil erosion and sedimentation or reconstruction of stream-crossings.

### 4.4.9 Cumulative Impacts

Cumulative impacts on soil resources resulting from this project in conjunction with other GNF projects would not be high. No excessive soil erosion would occur which, in conjunction with other project erosion, would dramatically impact resources. This analysis assumes that proper construction and mitigation practices would be employed to prevent excessive soil erosion and sedimentation. The cumulative impacts of all local projects would not eliminate any unique soil resources.

## 4.5 GEOLOGY AND GEOTECHNICAL CONDITIONS

### 4.5.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities would continue under the approved Jackpine Exploration Permit. This includes construction of one mile of access road, the approved exploration adit and surface facilities, i.e., the waste rock storage, soil storage piles, and percolation ponds. Impacts on geologic and geotechnical conditions will be minimal during the exploration program. The excavation of the adit will include the deposition of waste rock on less than 10 acres outside the adit portal. There will be no mining related disturbances on the plateau.

### 4.5.2 Alternative 2 - Proposed Action

#### 4.5.2.1 Topography and Geomorphology

The area that would be disturbed by the proposed mining, milling, and tailing disposal facilities would change from a hummocky shape to a more graded appearance, resulting in less infiltration and increased runoff. The major topographic change would be the tailing pond, which would become a plateau-like area with steep downstream slopes (1.6(H):1(V)) up to 140 feet high.

The shop, mill site, and surplus waste rock disposal areas would remain relatively flat areas that would easily revegetate, and eventually blend into the landscape.

By design, very little new disturbance would occur in the Placer Basin permit area. Existing disturbance is related to previous exploration. The proposed ventilation raises and escapeways would be sealed with a concrete plug, leaving only small level pads. Since access to Brownlee Creek would be only by helicopter, it would not be practical to bring in heavy equipment for site regrading.

Landslides and slumping are common along the East Boulder River Valley, and would be encountered by all the routes that are within the valley. The slumps appear to be related to flood irrigation practices that lubricate the fine textured soils. The occasionally oversaturated moisture conditions would increase the difficulty for road construction and maintenance.

Construction of power transmission line upgrades would cross terrain similar to the adjacent SG 31 and FS 205 access roads, and would cause minimal impacts to the landforms.

#### 4.5.2.2 Tailing Impoundment Stability

The proposed tailing embankment would be constructed from mine waste material and would be gradually raised over the life of the operation as storage requirements dictate. Since the embankment would be lined to contain the fine mill tailing, no phreatic surface would develop and the embankment would be more stable than if it were unlined. Static and seismic stability analyses indicate that the embankment would remain stable even if the liner were not present. The seismic analysis assumed a ground acceleration of 0.1 g (gravitational force), caused by a maximum credible earthquake of magnitude 7 on the Emigrant fault.

Based on foundation test drilling samples, IECO determined that the foundation would remain stable during the maximum credible earthquake if the foundation were saturated with water (the water table is at the surface). Testing indicates that the foundation material does not possess the characteristics that cause liquefaction (quicksand) during an earthquake.

Liquefaction is an important consideration in the design and engineering of certain large structures. Excess soil moisture could create a loss of cohesion between soil particles during seismic or earthquake pressures, causing a very unstable situation whereby the materials act more like a liquid than a solid during earthshaking. The critical location for liquefaction would be near the percolation ponds where excess mine water is disposed. If the area around the percolation ponds became saturated during the mine development when maximum water flows are anticipated, it would be advisable to either locate an alternate water disposal site, or undertake geotechnical studies to ensure that no pockets of liquefiable material are present.

#### 4.5.2.3 Subsidence

Subsidence of the surface area above underground mining projects can be a problem, especially in areas where mine excavations come relatively close to the surface and the supporting lithologies near the surface are not strong. The effects of subsidence can include slumping or depression of surface areas as well as changes in surface and groundwater flow regimes. However, it is not always easy to evaluate subsidence potential. That is the case for this project. The technical evaluation indicates that minor to no subsidence would occur.

SPGMR would leave a 20- to 50-foot-thick rock barrier (pillar) below the surface and use coarse mill tailing to backfill the stopes. All mine openings that intersect the surface, such as shafts, adits, and raises, would be plugged with concrete after mining is complete.

Mass subsidence is precluded by sand backfill. Surface subsidence may occur in areas where stoping advances to within 50 feet of the surface; however, the amount of resulting subsidence may be so slight that it is only detectable by instrumentation. Minor subsidence may occur in the remaining pillar as the intact rock fractures in response to mining stresses. Fracturing and minor subsidence could intercept local groundwater flow and create a conduit for surface water recharge. Fracture systems for slopes at a depth of 50 feet could extend to a width of 150 feet at the surface. Increased surface water capture can result in increased mine water discharge from portals.

#### 4.5.2.4 Tailing Impoundment Reclamation

SPGMR's estimates for settlement of material within the tailing impoundment may be low. The volumetric difference between settlement surface and the reclaimed surface would be equal to the amount of cap rock required for access and for establishment of a positive runoff gradient. Because the impoundment would not include a system to dewater the tailing mass, bearing strength of the tailing surface would be minimal and the proposed method of bulldozing the tailing surface to develop the reclamation gradient would be impracticable. In addition, the lack of a dewatering system would increase both the degree and time of consolidation and ultimate settlement. Given the strict construction specifications for the reclamation cap and the unknowns associated with the bearing strength, degree of consolidation, and settlement rate of the tailing mass, it is anticipated that without additional studies the proposed reclamation of the tailing surface would have low probability of success. Detailed engineering studies of the tailing mass at closure would be required along with additional studies to develop accurate estimates of reclamation requirements. Reclamation goals for the tailing impoundment are to restore the area to pre-mining land use objectives.

#### 4.5.2.5 Landslides, Slope Stability, and Avalanches

Potential slope stability problems are only evident along the proposed access corridor, and they have no major effect on the environment. During geologic time, mass failures have occurred in the Madison limestone near the proposed facility site, so during a major earthquake additional failures may occur. It is not possible to determine exactly where a potential failure might occur, or how environmental problems related to the proposed development would compare to other related natural catastrophic problems caused by the same earthquake.

Avalanches commonly occur in the upper reaches of the East Boulder drainage, above the project area. There is no evidence of avalanche paths or run-out areas that would affect the proposed facilities or tailing impoundment area. Avalanches occurring near Brownlee Creek would not affect the site.

#### 4.5.2.6 Geologic Resources

The proposed mining operation would have no adverse effect on the possible future extraction of chromite, copper, or nickel deposits in the Stillwater Complex. It is highly improbable that any economic placer or lode deposits exist beneath the proposed tailing pond.

### 4.5.3 Alternative 3 - Modified Tailing Impoundment Configuration

The alternate tailing impoundment configuration would reduce the outside slope of the tailing embankment from 1.6(H):1(V) to 2(H):1(V) to improve the probability of revegetating the embankment slope. Since the outside perimeter of the embankment cannot move any closer to the East Boulder River, flattening the embankment slope has the effect of moving the embankment into the storage area, reducing the storage capacity by approximately 672,000 cubic yards. It is difficult to regain the lost storage capacity by increasing the height, because as the height increases, the additional embankment volume consumes the added storage space.

Reducing the outside embankment slope increases the stability safety factor of the embankment from 1.7 to 1.9, an increase of approximately 12 percent. (As described in Section 2.4.1.2, these numbers represent ratios of the forces holding the dam in place vs. the forces acting to cause dam failure. A factor greater than 1.0 indicates the modeled stability forces are greater than the predicted failure forces.) However, either number is considered sufficiently "safe" according to criteria developed by the Army Corps of Engineers (1982).

Finally, it should be understood that Alternative 3 and the original tailing impoundment from the Plan of Operations are conceptual designs. Evaluation of stability, reclamation, and other parameters are therefore conceptual as well.

### 4.5.4 Alternative 4 - Alternative Access Road/Power Line Alignments

The alternate routes for the access roads would generally encounter similar geologic conditions as the proposed route and have no effect on the geology. However, the alternate routes would be more prone to soil slumping and slope failure than SG 31.

### 4.5.5 Alternative 5 - Power Supply Corridor Systems

Implementation of either system would have no impact on geologic resources or be affected by adverse geotechnical conditions.

### 4.5.6 Alternative 6 - Water Treatment Alternatives

Implementation of any of the water treatment alternatives would have no additional impacts beyond the impacts described for Alternative 2 in Section 4.5.2.

### 4.5.7 Alternative 7 - Proposed Action with Modifications

Impacts on geologic and geotechnical conditions from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.5.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce or eliminate residual geologic or geotechnical impacts remaining after the application of SPGMR's mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Surface Water Control. A commitment by SPGMR to permanently maintain an effective surface water diversion around the tailing impoundment would enhance the long-term stability of the impoundment after closure.

Tailing Impoundment Reclamation. The effective use of rock armor and the resulting enhanced conditions for successful revegetation would promote the long-term stability of the impoundment's outslope.

Impoundment Stability. The completion and submission of geotechnical testing and evaluations beneath the area to be covered by the impoundment embankment, and final impoundment designs prior to construction, would allow the agencies to verify adequacy of the impoundment's location and design to promote the construction and operation of a stable facility. Groundwater monitoring of any flows beneath the impoundment may enable SPGMR and the agencies to identify potential hazards to dam stability in time to implement mitigative measures. A contingency plan prepared by SPGMR would identify potential impacts and mitigation measures to be implemented should the tailing impoundment fail. The immediate implementation of an approved contingency plan after dam failure could reduce the severity and duration of adverse impacts to the environment.

### 4.5.8 Alternative 8 - Twin Production Adits

Geologic or geotechnical concerns relating to mine development, operation and closure would be virtually the same for Alternative 8 as for Alternative 7, Section 4.5.7. Differences between the two alternatives arise from the additional waste rock created by development of two production adits, and geotechnical engineering concerns over tunnel construction and safety margins between the adits.

SPGMR has calculated that the twin productions adits would produce approximately 28,000 $yd^3$ more waste rock than the proposed action. The reason why the difference in waste rock volumes between the two alternatives is so low (<1 percent of the total waste rock produced over the life of the mine) is that each of the twin production adits is of a smaller diameter (13½ ft) than the adit in the proposed action (16 ft), and the Brownlee Creek adit would not be used in Alternative 8. An approximation of the waste rock volumes produced for each alternative can be shown by:

- Proposed Action Volume = Main Adit Volume + Brownlee Creek Adit Volume

  Main Adit Volume = $(18{,}550\ ft)(3.1416)((8\ ft)^2) \div (27\ ft^3/yd^3)$
  Brownlee Creek Adit Volume = $(5{,}640\ ft)(3.1416)((8\ ft)^2) \div (27\ ft^3/yd^3)$
  Proposed Action Volume ≈ 180,000 $yd^3$

- Alternative 8 Volume = Two Adit Volumes + Crosscut Volumes

  Adit Volumes = $(2)(18{,}550\ ft)(3.1416)((6.75\ ft)^2) \div (27\ ft^3/yd^3)$
  Crosscut Volumes = $(18)(50\ ft)(3.1416)((6.75\ ft)^2) \div (27\ ft^3/yd^3)$
  Alternative 8 Volume ≈ 202,000 $yd^3$

- Added Waste Rock from Alternative 8 = 202,000 - 180,000 = 22,000 $yd^3$

The difference in volumes between SPGMR's calculated 28,000 $yd^3$ and the above 22,000 $yd^3$ is relatively small and attributable to SPGMR more accurately factoring in all mine engineering variables. The approximately 12 percent increase in material from construction of two production adits should cause no additional negative project impact since waste rock storage space is available within the proposed facilities East Boulder permit area.

The Brownlee Creek permit area would not be disturbed.

SPGMR has indicated that the twin production adits of bedrock would be located on a parallel course and separated by approximately 25 to 50 feet. Crosscuts would connect the two tunnels at intervals of approximately 1,000 feet. A chief concern is that the adits be separated by an adequate distance so as to preclude the potential for failure of the separating walls. Also, adit design would have to account for ventilation requirements for workers, including emergency operating conditions. Insufficient baseline information about tunnel design and bedrock competence was available to evaluate these concerns.

#### 4.5.9 Cumulative Impacts

The East Boulder area contains a variety of minable and potentially minable commodities such as platinum, palladium, chromium, copper, nickel, iron, gold, and optical calcite. Over 2,000 mining claims are reported to exist within the Stillwater Complex Integrated Resource Area (IRA). Current mining and exploration activities include platinum/palladium properties by SMC. The U.S. Forest Service reports that Plans of Operation have been filed for 15 sites within the IRA study area, most for small scale exploration projects.

Exploration for platinum/palladium and chromite would continue periodically along the full length of the Stillwater Complex, and, depending on the results, one or more new mines may be proposed. Exploration for gold may also continue in the Placer Basin (to the south) and in the Gold Hills/Deer Creek area (to the north). The development potential is unknown, but statistically the probability of any kind of mine development is low.

Oil and gas exploration may take place along the front of the Stillwater Complex and the Beartooth Thrust Zone, but this would not occur until EA/EIS related issues are resolved by the U.S. Forest Service and other appropriate agencies. Until then, exploration will be limited to geophysical investigations such as seismic blast wave interpretation and radar reflection analysis.

#### 4.5.10 Geologic Hazards

Earthquake hazards were evaluated by Klohn Leonoff Consulting Engineers (1981). The earthquake hazards were determined by analyzing all earthquakes within 200 miles of the proposed mine site and then using the maximum probable ground acceleration as the basis for all engineering design. Based on the magnitude 7.1

Hebgen Lake earthquake and the magnitude 6.5 Yellowstone earthquake, it was estimated that the ground acceleration would be between 0.05 g and 0.08 g. Seismic zoning maps prepared by the U.S. Army Corps of Engineers indicate that the site is on the border of moderate damage (0.05 g acceleration) and severe damage (0.1 g acceleration).

Klohn Leonoff used fault rupture techniques to estimate earthquake magnitudes from ruptures of the Emigrant, Mammoth-East Gallatin-Gardiner, and Madison Range fault systems. The worst case analysis indicates that facilities damage could occur by the rupture centered in the Emigrant Fault, but Klohn Leonoff suggests this is unlikely.

In the past, some areas underlain by Madison limestone have become unstable and failed. Apparently, the Hebgen Lake earthquake in 1959 triggered Madison limestone landslides (Beak 1982d), but further detailed investigations would be required to analyze the stability of the Madison limestone immediately adjacent to the proposed mine, mill, and tailing disposal facilities. Based on their analysis of the potential earthquake severity, Klohn Leonoff recommends that engineering designs assume a bedrock acceleration of 0.1 g.

Avalanches are common in the project area, but none of the facilities are proposed to be located in areas of high avalanche hazard (Richmond 1982). The Brownlee Creek portal is in an area frequented by avalanches, but the portal and site areas are protected.

### 4.5.11 Other Economic Resources

Some thin coal beds are present in the sedimentary rocks north of the project, but these currently have no economic potential. No record of oil or gas production of potential has been reported in the immediate vicinity. The limestone has some economic potential, but considering the location and other more accessible sources, it has negligible development potential. Limestone does make a good gravel road surfacing material and may be used for this purpose by the mine. The alluvial and glacial material could be used as a source of aggregate for local construction.

The Stillwater Complex and the underlying metamorphosed sediments contain known resources of platinum group metals, nickel, copper, chromite, iron, and possibly aluminum from the plagioclase cumulates. To the south, gold and copper deposits are present in the Independence Mining District. Gold and copper veins may also be associated with some of the igneous intrusives. Optical calcite has been mined in Sweet Grass County from hydrothermal veins cutting sedimentary deposits in the volcanic Livingston Formation, but no known occurrences exist in the mine permit area.

## 4.6 WILDLIFE

### 4.6.1 Alternative 1 - No Action

Under this alternative, existing mine and development activities will continue under the approved Jackpine Exploration Permit. Approved facilities at the East Boulder permit area include an exploration adit, portal yard, support facilities, waste rock storage area, percolation ponds, and soil storage area. These facilities will occupy approximately 30 surface acres. The impacts have been previously evaluated in the Jackpine Exploration Project EA (GNF 1988), and included the following:

- Increased daily traffic on FS 205 to and from the adit during the winter period is expected to place additional stress on deer wintering in the East Boulder River Valley, resulting in indirect loss of mule deer habitat due to avoidance of the area.

- Snow removal activities of FS 205 are likely to result in development of physical barriers to mule deer movement. As part of the settlement agreement for the appeal of the EA, SPGMR agreed to conduct snow removal operations in a manner such that large continuous snow berms will not be formed and wildlife travel will not be impeded.

- The EA indicated that increased deer/vehicle collisions could be expected year-round but especially during winter when snow berms and drifts would make crossings slower and more hazardous for wildlife. As part of the same settlement agreement for the Jackpine EA (GNF 1988, Appendix A), SPGMR agreed to develop an employee transportation program to reduce traffic through deer winter range.

- Maintenance of an open road up the East Boulder River Valley throughout the winter was expected to increase mountain lion harvest in this area. An increased harvest of furbearing animals (coyote, bobcat, marten, etc) from the upper East Boulder River drainage was also expected as a result of improved winter access, along with an increase in recreational access for hunting and fishing. In the settlement agreement, SPGMR agreed to restrict and monitor access to the project site, to help reduce hunting pressure on big game and to offset the loss of hiding cover and improved access.

- Threatened or endangered species could potentially suffer increased mortality indirectly. In the settlement agreement, SPGMR agreed to restrict helicopter traffic near the peregrine falcon hack site, collect roadside carrion on the East Boulder River road from November 1 to April 1 when wintering bald eagles are present, restrict firearms on the project site; institute strict control of food waste and refuse, and provide an employee education program on threatened and endangered species.

**4.6.2 Alternative 2 - Proposed Action**

Construction. Impacts potentially resulting from construction of the various facilities include direct mortality, destruction of habitat, and disturbance. Indirect impacts may also occur due to improved hunting access and road traffic.

Assuming construction and operation of the approved exploration program, approximately 233 additional acres of wildlife habitat would be lost within the three permit areas, and replaced by buildings, tailing pond, yards, roads, and other facilities. This would include 200 acres at the East Boulder permit area, 3 acres in the Brownlee Creek permit area, and 30 acres at scattered locations in the Placer Basin permit area. A portion of this acreage has already been disturbed by clearcutting and mine exploration activities at the East Boulder permit area and mine exploration activities at the Placer Basin permit area. Most of the affected habitat would be lodgepole pine forest at the East Boulder and Brownlee Creek permit areas, and a mosaic of subalpine forest/meadow/rock in the Placer Basin permit area. The construction period (start up to full production) would last approximately 5 years.

Approximately 2.4 miles of new road would be constructed within the East Boulder permit area for access to mine portal facilities, and about 0.2 mile of new road would be constructed in the Placer Basin permit area. Use of roads within the East Boulder permit area would be restricted to mine-related personnel, while the new roads in the Placer Basin permit area may be open to public use. Additional minor direct losses of habitat may result from upgrading of access roads including FS 140 and 205, and SG31 and an adjacent transmission line, but additional habitat losses cannot be quantified because design information is not available. Upgrading of these roads would improve access for mine vehicles, but would probably not affect public access since roads are already present.

During construction, larger and more mobile animals would be displaced from the affected area, while smaller and less mobile animals may be adversely impacted or perish. Loss of 233 acres of habitat could result in reductions in carrying capacity and local populations of wildlife. Additional habitat acreage within and adjacent to the three permit areas and along access roads could also be disturbed by noise and human activity, resulting in lowered wildlife use. However, construction disturbances within the Placer Basin and Brownlee Creek permit areas and along access roads would be short-term, dispersed, and much lower in intensity than at the East Boulder permit area. Direct and indirect impacts to individual species are described below.

Elk

Nearly all of the project facilities are located within general elk habitat, but only the East Vent Raise within the Placer Basin permit area would be located in an identified area of concentrated use (summer/fall elk range). The East Vent Raise would consist of a fenced 8-foot-diameter ventilation raise, and no road access to this location is planned. The East Boulder permit area is located in an area of low elk use. Some upgrading of FS 140 on the East Boulder Plateau could occur in elk summer/fall use areas. Elk may be temporarily displaced from small portions of this habitat during construction, and may have minor and unquantifiable long-term losses of habitat. Mine-related traffic on FS 140 would minimal (up to 10-15 trips per week during the summer periodically) and should have minor impacts to big game. All of the facilities would be located in areas traversed by elk during seasonal movements, but no known specific routes would be affected.

Elk have been selected by GNF to monitor impacts to migratory big game, because they are less tolerant of human related activities than mule deer and moose, and because there is more literature and guidance available for elk than for other species. GNF has a forest-wide standard to manage elk habitat to provide for slight increases in populations (GNF 1987a). The GNF uses a habitat effectiveness index (HEI) determined by the HEI3 computer model to measure how cover and open roads affect full utilization of an area by elk. The GNF plan includes a forest-wide standard that HEI will be maintained at a minimum of 70 percent. Maintaining elk habitat effectiveness at or above 70 percent indicates that elk can use 70 percent or more of the habitat available to them.

GNF information on HEI has been developed as part of the Stillwater Complex IRA (GNF 1990). The East Boulder permit area lies within two subcompartments, 112-02 and 115-01. In subcompartment 112-02, existing HEI is 0.56, which is below the forest standard primarily due to timber harvest and roading from the previous East Boulder timber sale. Since development of the East Boulder Mine Project would involve minor amounts of new roads in a localized area, HEI would remain about the same (0.56) with construction of the project (GNF 1991). Existing HEI in subcompartment 115-01 is high (0.90) due to the near absence of roads, and would change to 0.75 with construction of the project. The east portion of the Placer Basin

permit area is in subcompartment 115-03, while the western portion is in subcompartments 116-04, 05, and 06. HEI for 116-04, 05, and 06 would also remain about the same, at 0.86.

Since the release of the draft EIS in May 1991, HEI has been reevaluated. During the initial analysis in the Stillwater Integrated Resource Area (IRA) analysis, the existing elk habitat effectiveness index (HEI) was estimated at about 0.56 in subcompartment 112-02, below the 0.70 Forest standard. Predicted Reasonable Foreseeable Development (RFD) included the mine in place with little new roading, and a 100 acre Forest Service fuels removal project with no new roading in the subcompartment. These proposed projects would result in an HEI about the same as existing since there was little new roading and hiding cover would remain above 40 percent. The fact that HEI did not meet forest standard on a subcompartment basis in the Stillwater IRA was identified, therefore HEI needed to be analyzed on a specific project level (See Table 4.6-1).

The Forest Service Big Timber District biologist and MDFWP area wildlife biologist addressed elk HEI and the effects from the East Boulder Mine on elk HEI. Current Gallatin National Forest Plan direction doesn't specify the area to be analyzed for HEI. Initial elk HEI for the Stillwater IRA analysis was done on a subcompartment basis (See Figure 4.6-1) since a vast area was being considered and cover estimates could be obtained relatively easily from the Timber Stand Data Base. Subcompartment 112-02 is only 3,248 acres in size, while HEI analysis works best for areas ranging from 4,000 to 10,000 acres in size. Another consideration is the fact that subcompartment 112-02 has roughly one-fifth of its area on the East Boulder Plateau where there is very little to no cover, resulting in less cover overall in the subcompartment, and thereby reducing HEI.

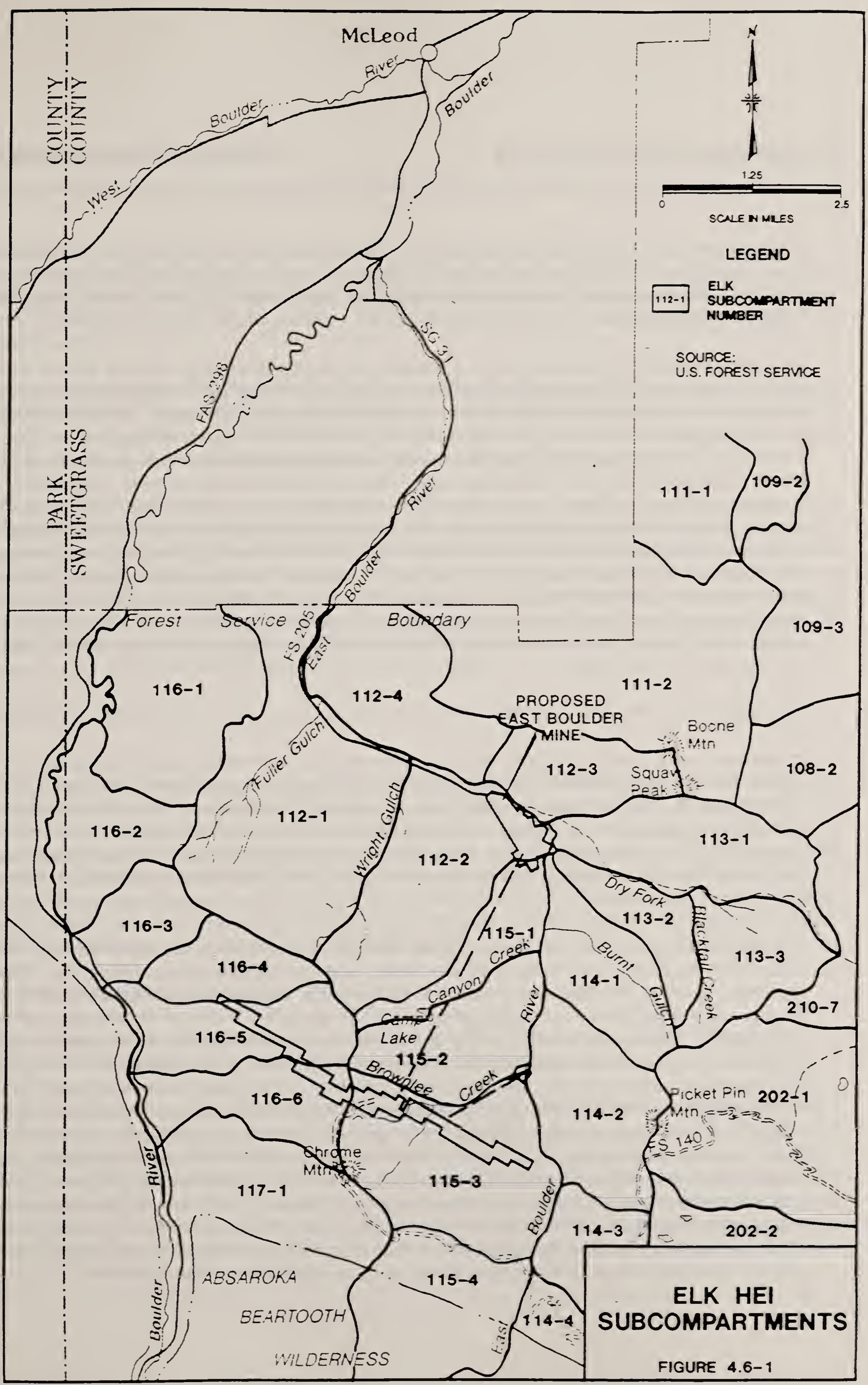
The District biologist and MDFWP area wildlife biologist both concluded that HEI needed to be addressed on a larger, more logical summer/fall herd unit of similar habitat type. It was determined the combination of subcompartments 112-01, 112-02, and 115-01 within the forest boundary included similar habitat types used by elk during the summer/fall season and would be the most logical analysis area (herd unit). This increased the area analyzed to about 10,308 acres. Past and current summer/fall elk use is low in subcompartment 112-02 and in the general area. Elk use will ultimately increase as vegetation becomes reestablished in the clear cuts from the East Boulder timber sale in subcompartment 112-02. It will take an estimated 15 years for the logged area to become effective cover for elk. The MDFWP area biologist felt that current elk security was adequate for this general area and a road closure in this subcompartment was not needed. Elk populations in the entire Boulder drainage are at an all-time high and MDFWP is starting to have depredation problems, with too many elk wintering on private land in the area. It was felt that if the East Boulder Mine were to go in, there would be a dramatic increase in use of the area, particularly during hunting season. Even so, it was felt there should be vehicular access into at least part of the Lewis Gulch drainage, allowing hunters the opportunity to harvest elk in the drainage. As a result, it was felt there should be a seasonal road closure (locked gate) from October 15 through the close of the general big game hunting season, at the juncture of Road 6644 and 6644A. In this herd unit, existing HEI is about 0.68 and would increase to about 0.71 from the seasonal closure of about 2.7 miles of road, which would mean a net increase of 0.6 miles and an additional 143 acres of lodgepole pine harvested due to the East Boulder Mine and its adjacent facilities.

TABLE 4.6-1

EAST BOULDER MINE
ELK HABITAT EFFECTIVENESS INDEX
ALL ROADS OPEN

| Subcompartment | Acres | Existing HEI | Proposed Activity | Harvest (acres) | New Road Miles | New HEI | Seasonal Closure |
|---|---|---|---|---|---|---|---|
| 112-01 | 5,587 | .75 | | | | .75 | |
| 112-02 | 3,248 | .56 | E. Boulder Mine | 60 | -0.1 | .56 | .61 |
| 112-03 | 1,511 | .97 | | | | .97 | |
| 112-04 | 2,363 | 1.00 | | | | 1.00 | |
| 112 Total | 12,709 | .73 | | | | .73 | .79 |
| 113-01 | 2,556 | .75 | Ammadon gate open (year round) | | | .61 | |
| 113-02 | 1,195 | 1.00 | | | | 1.00 | |
| 113-03 | 1,829 | .67 | | | | .67 | |
| 113 Total | 5,580 | .88 | | | | .78 | |
| 115-01 | 1,473 | .90 | | 83 | +0.7 | .75 | |
| 115-02 | 2,069 | .97 | | | | .97 | |
| 115-03 | 3,686 | .88 | | | | .88 | |
| 115-04 | 1,102 | .59 | | | | .59 | |
| 115 Total | 8,330 | .87 | | | | .85 | |
| Herd Unit* | | | | | | | |
| 112-01 | 5,587 | .75 | | | | .75 | |
| 112-02 | 3,248 | .56 | | 60 | -0.1 | .56 | |
| 115-01 | 1,473 | .90 | | 83 | +0.7 | .75 | |
| Herd Unit Total | 10,308 | .68 | | 143 | +0.6 | .67 | .71 |

* These 3 subcompartments are grouped together to comprise one elk herd unit.




## ELK HEI SUBCOMPARTMENTS

FIGURE 4.6-1

In subcompartment 113-01, existing HEI is 0.75. The gate that accesses the Dry Fork is kept locked by a private landowner. If this gate were left open, HEI would drop to 0.61, although this subcompartment is only 2,556 acres in size. On a compartment level (5,580 acres), existing HEI would drop from 0.88 to 0.78 if the gate were left open.

Elk vulnerability from hunting is due to a combination of several factors, including habitat security and access, characteristics of the hunting season, and weather. Since the project would not involve construction of any new roads except short spur roads at the project facilities, no increase in road access would occur. As with the Jackpine Exploration Project, there would be increased access in winter since the East Boulder River road would be kept open. In addition, hunting pressures are likely to increase due to the increased human population in the area. Experience in two hunting districts near the Stillwater Mine at Nye suggests that hunter numbers are likely to increase with increased human population (Shawn Stewart 1991). Although deer and elk hunter numbers have decreased about 20-30 percent since 1980 in District 520 (apparently due to decreased hunting opportunities from restriction of access by private landowners), deer hunter numbers have increased 30 percent since 1980 in District 575, which still has good hunting access. Overall, deer hunter numbers in MDFWP Region 5 (including the study area) have increased 26 percent since 1980, apparently due to increased human population. The numbers of hunters using the East, Main, and West Boulder River Valleys are likely to increase by similar amounts during construction and operation of the East Boulder Mine facilities.

Mule Deer

The extreme northern end of the East Boulder permit area is located within mapped mule deer winter range (Figure 3.6-4). Construction would result in direct loss of up to 10 acres of wintering habitat. Up to 10 acres of mule deer winter range would be directly impacted. No significant losses in mule deer carrying capacity are anticipated since the affected area is less than 1 percent of the mule deer winter range in the East Boulder River Valley within GNF. In addition, mature Douglas fir stands, which provide crucial snow and thermal cover for wintering mule deer, do not appear to be present and would not be harvested in the East Boulder permit area.

Upgrading of about five miles of access road, including SG 31 just north of the GNF boundary and FS 205 on the GNF, would also occur within mule deer winter range and high use spring/summer/fall range. Road upgrading, including widening, improvement of visibility, and addition of turn-outs and guard rails could result in minor long-term loss of habitat, which cannot be quantified at present because this information is not available. Construction activity on the access road would probably occur in the summer and would therefore not directly disrupt mule deer use of the area during winter. Snow removal could potentially cause development of barriers to deer movement in the winter by creating large, continuous snow berms/walls which would impede wildlife movement across the road. The entire East Boulder permit area, and the area along FS 205 is also spring/summer/fall mule deer habitat. Increased human use and associated vehicular activity may also displace local deer use away from the road and East Boulder permit facilities, and result in indirect loss of spring/summer/fall and winter habitat. Due to increased traffic, the potential for vehicle collision with deer would increase year round, especially in winter. GNF has a forest-wide standard to manage mule deer habitat to provide for slight increases in populations over the 10-year period (GNF 1987a). In addition, the plan states "big game winter range will be managed to meet the forage and cover needs for deer, elk, moose, and other big game species in coordination with other uses."

Other Species

Possible upgrading of road SG 31 within riparian habitat north of the GNF boundary could result in minor loss of white-tailed deer year-round habitat. Increased roadkill mortality would probably occur due to increased traffic.

Small moose populations along the East Boulder River near the East Boulder permit area could be displaced during construction. Minor, and generally short-term impacts, would occur to moose summer/fall habitat in the Placer Basin permit area. Construction in this area would be spread out in time (over 20 years) and would involve relatively small amounts of workers, equipment, and facilities.

The East Boulder permit area and surrounding area are black bear spring/fall habitat. This habitat would be eliminated within the permit area, and bears may be displaced from the surrounding area. Unless a strict refuse control and collection program is used, black bears could potentially be attracted to the project area and result in adverse human/bear interactions. The Placer Basin permit area also includes black bear summer/fall habitat. Construction activities would occur at a number of sites scattered across the permit area, but would directly impact only 30 acres. Construction activities would also be spread out in time (over 20 years), and would involve relatively small numbers of workers at any time. Increased hunting of black bear may occur in the area due to increases in human population.

No impacts are likely to occur to bighorn sheep since none are known to consistently occur in the project area.

Habitat losses and displacement would also occur for other species, including raptors, upland game (blue and ruffed grouse), and mountain lion, but the effects would be inconsequential on a regional basis. Improved human access in winter along the East Boulder Road could cause an increased hunting pressure on mountain lions and trapping of pine marten. No impacts to raptors are expected from the upgraded transmission line since it would use Rural Electric Association (REA) approved raptor proof design. No significant impacts are expected to pine marten and northern goshawk habitat, since none of the areas that would be disturbed appear to provide suitable habitat. No direct impacts are expected to occur to northern goshawk, since the project would not impact old growth forest.

Threatened, Endangered, and Sensitive Species

Potential impacts to threatened, endangered, and GNF sensitive species are expected to be similar to those for Alternative 1, and have been evaluated in detail in the Biological Assessment (see Appendix D).

Bald eagles may be affected by implementation of the East Boulder Mine Project from feeding on roadkill carrion, which could result in potential vehicle/bald eagle collisions on SG 31 along the lower East Boulder River. Increased mine-related traffic on the East Boulder River Road may cause an increased number of roadkills, since it crosses through mule deer winter range and white-tailed deer year round range. The carcasses provide a food source which may attract bald eagles when they are present in winter, and may result in injury or death due to collisions or possibly from shooting. Potential impacts may be greater than evaluated for the Jackpine Exploration Project, since a larger number of personnel would be involved in construction, and the project would extend over a longer time period.

Peregrine falcons are being reintroduced at a hack site west of the East Boulder Mine Project. Reintroduction began in 1989. Helicopter traffic during construction could potentially interfere with hacking (release) activities at this site, by flushing or frightening the birds. Similar impacts could occur at future, naturally established nest sites should any become established in the area. Peregrine falcons are extremely sensitive to disturbance during courtship, early nesting, and fledgling.

The East Boulder Mine Project would probably have no impact on grizzly bears, since there are no resident grizzly bears in or near the project area. Transient grizzlies could be affected if they came into the project area and found food or garbage available at the site or if they were shot or had to be removed. Greater impacts could occur if the Yellowstone population expanded into the project area during the 27-year project period.

No impacts are expected to occur to Forest Service sensitive species including western big-eared bat, boreal owl, harlequin duck, or other species, since habitats they require are not known to occur in the impact area.

Operations. Impacts begun during exploration adit construction (Alternative 1) and the construction phase would continue through the estimated 27-year life of the mine. Habitat losses caused by construction would continue. Disturbance due to human activity and noise would be similar to the construction phase at the East Boulder permit area. Wildlife would become more or less habituated to human presence, depending on species, resulting in improved use of undisturbed habitat adjacent to the facilities. Daily road traffic on SG 31 and FS 205 could be greater than during the construction period, and may result in increased road kills, primarily mule and white-tailed deer.

Some of the reagents used in the mill are potentially toxic, including potassium amyl xanthate and dithiophosphate, but neither the process water nor the tailing solution would contain toxins in concentrations known to be harmful to wildlife (Section 2.3.3.2). Wildlife could potentially drown in the tailing pond, but this has not yet happened at the Stillwater Mine. In the unlikely event of a tailing dam failure, riparian and other habitats downstream of the break would be severely damaged or lost.

Closure and Reclamation. The goal of the reclamation plan is reestablishment of wildlife habitat, specifically mule deer habitat at the East Boulder permit area. In the East Boulder permit area, revegetation would include seeding a variety of grasses and forbs and planting of trees and shrubs. At the more limited areas of disturbance at higher elevations, grasses and forbs would be seeded. Species have been selected based on pre-mining occurrence (i.e., native and naturalized species), potential for good establishment and growth, palatability to wildlife, usefulness for wildlife habitat, soil stabilizing capabilities, and commercial availability. Reclamation would include removal of surface facilities and roads, closure of mine workings, recontouring of portal pads, dewatering of the tailing impoundment, spreading of soil material, and revegetation.

If implemented as designed, most of the affected areas would be satisfactorily reclaimed. Limited reestablishment of vegetation would likely occur on the steep face of the tailing impoundment, which is to be covered with riprap and not seeded. Poor revegetation results could also occur at higher elevations where conditions for vegetation establishment and growth are more severe. As human activity ceases and vegetation becomes established, wildlife use of the former disturbed areas would increase. Wildlife may be attracted to the newly revegetated areas which may have adverse impacts on the reestablishment of vegetation depending on the palatability of the plant species selected. With time, wildlife use of the former disturbed areas should be generally similar to use of the surrounding areas.

Upgraded portions of FS 205 and FS 140 would remain open after closure of the mine. and would provide continued access to the areas for recreational use, including hunting, similar to pre-project conditions.

### 4.6.3 Alternative 3 - Modified Tailing Impoundment Configuration

Modification of the tailing impoundment configuration described in Alternative 2 would occupy the same area as the proposed impoundment, and would result in the same loss of wildlife habitat. Chances of successful establishment of vegetation on the tailing dam face may be enhanced with the reduced-slope modification, potentially resulting in an earlier return of the area to favorable wildlife habitat after closure.

### 4.6.4 Alternative 4 - Alternative Access Road/Power Line Alignments

Bench Route (R2). Use of the Bench Route would place the road almost entirely in agricultural land north of the GNF boundary, as opposed to the current location primarily in or adjacent to riparian areas along the East Boulder River. It would also eliminate the need to upgrade four stream crossings across the East Boulder River and across Elk Creek. The new road would avoid about five linear miles of road and transmission line corridor in and adjacent to riparian habitat and would reduce potential losses of riparian habitat due to road and transmission line upgrading. With this alternative, it is assumed that all of the mine-related traffic would use this new road and that the current road would be left in place and used mainly by local traffic. During operation, white-tailed and mule deer mortality due to vehicle collisions would probably be reduced with this alternative compared to use of the current road by mine traffic. The alternative route would have better visibility and may have lower deer occurrences because it would not be located in or adjacent to the riparian area. Existing impacts by local traffic on the current East Boulder Road would continue, and some increases in non-local traffic are likely to occur. With this alternative, the presence of two roads in mule deer winter range may have minor effects on deer through habitat fragmentation. The potential for deer collisions would continue after closure of the mine, as long as the road is used as the primary access route to the GNF.

Bench/Valley Route (R4). Use of the Bench/Valley Route would have similar impacts to the Bench route, but would be less beneficial to wildlife. About four linear miles of road and transmission line corridor in and adjacent to riparian habitat would be avoided, but about one mile of upgraded road would still be located in and adjacent to riparian habitat. Use of this alternative would require upgrading of one additional bridge.

### 4.6.5 Alternative 5 - Power Supply Corridor Systems

Alternative 5A includes construction of a new 69-kV transmission line for about 5.7 miles from a new substation on the existing Anaconda-Billings 161-kV line north of Springdale, to the Duck Creek Tap located about 4 miles northeast of Springdale; and upgrading of about 3 miles of transmission line from the McLeod Substation to the lower end of road SG 31. The intermediate portion between Duck Creek Tap and McLeod would not require any construction, and upgrading of the existing transmission line located along SG 31 and FS 205 is covered under the proposed action. About 9 miles of 69-kV transmission line would be constructed or upgraded under this alternative, located primarily in grassland and agricultural habitat.

Current information on potential wildlife impacts was obtained from the Montana Department of Fish, Wildlife, and Parks (MDFWP) (Claire Simmons 1990). Bald eagles currently forage within the area of

potential new construction (4-5 miles north of Duck Creek) particularly in riparian habitat. Wintering populations of bald eagles are increasing along the Yellowstone River, but the nearest active bald eagle nest is more than 6 miles from the nearest proposed area of disturbance.

The area of proposed development is within year-round, high-use mule deer habitat; winter numbers peak at 600-700 animals. Pronghorn antelope also occur in the area on a year-round basis, but at much lower densities than mule deer. White-tailed deer are scattered throughout the area, mainly in association with riparian habitat along Duck Creek and the East Fork of Duck Creek. Elk winter range would not be directly impacted by development of this alternative. No prairie dog towns are known to occur within the proposed project area, and none were noted during aerial surveys of the proposed route on September 26, 1990.

The primary impacts would include disturbance to wildlife during construction, and generally short-term and minor losses of wildlife habitat in grasslands and hay meadows. Construction of the new substation may involve a permanent loss of about one-quarter acre of habitat. Construction, operation, and reclamation of these transmission line segments would be implemented in a manner that would reduce potential adverse impacts to wildlife populations. New poles would be designed and installed to avoid bird electrocution. Construction and reclamation activities would be scheduled during the summer to avoid disturbance of winter mule deer populations and wintering bald eagles. To the extent possible, construction would avoid wetlands and riparian zones. Disturbance to sagebrush, an important food source for mule deer and pronghorn antelope, would be minimized. With implementation of these mitigative measures, minimal adverse impacts to wildlife are anticipated from development of this alternative.

Alternative 5B is similar to 5A, except that the northern segment from the existing Anaconda-Billings line to the Duck Creek Tap would be only 4.5 miles long. Impacts would be similar but would occur over a shorter route, and would cross wetlands at one location.

### 4.6.6 Alternative 6 - Water Treatment Alternatives

Implementation of a water treatment alternative would have no impacts in addition to those described for Alternative 2 in Section 4.6.2.

### 4.6.7 Alternative 7 - Proposed Action with Modifications

Impacts on wildlife from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.6.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce residual wildlife impacts remaining after the application of SPGMR's mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Wildlife. Disturbed areas near roads must be seeded with plant species unpalatable to big game. This action would help reduce wildlife roads kills and reduce the potential for eagles to forage on the access route. The plant species used should be coordinated with GNF.

SPGMR would contact both local GNF and MDFWP biologists to coordinate construction activities schedules in order to minimize wildlife impact during critical times.

Helicopter flights would avoid low-level flight in winter along bald eagle feeding/roosting areas of the East Boulder River. These areas and peregrine falcon avoidance areas will be clearly identified in coordination with GNF and MDFWP biologists to ensure pilots and employees are fully informed.

A fence would be installed around the tailing impoundment to prevent wildlife intrusion. Details such as fence height, construction material, number of gates, etc. would be provided to GNF and DSL to evaluate its suitability.

SPGMR would also be required to abide by the mitigation measures set forth in the Jackpine Environmental Assessment Decision Notice, as amended (Appendix B, see also Section 2.5.12.1).

East Boulder Plateau. Breakouts on the East Boulder Plateau (Placer Basin), scheduled to occur throughout the life of the mine, would be approved by GNF and DSL prior to their construction. A threatened and endangered species survey would be conducted prior to approval of any breakout as deemed necessary by the agencies.

### 4.6.8 Alternative 8 - Twin Production Adits

Impacts to wildlife resulting from implementation of Alternative 8 would be similar to those described for Alternative 7 (Section 4.6.7) with the important exception that no habitat loss or impacts to wildlife would occur in the Brownlee Creek permit area.

### 4.6.9 Cumulative Impacts

Other projects potentially affecting wildlife resources in the study area include wildlife habitat and range improvements by GNF and Custer National Forest (CNF), beaver reintroduction to the Main Boulder River drainage, timber stand evaluation and potential harvest in several areas, continued development of the Stillwater Mine, and exploration activities by a number of mining companies. The impacts of these projects may individually be beneficial or adverse to local and migratory wildlife. Combined with the impacts of the East Boulder Mine Project, they produce cumulative wildlife impacts. Elk move the greatest distances from summer to winter habitats and, therefore, have the greatest potential to be affected by various projects. The following discussion is centered on this species.

GNF plans aspen habitat improvement, browse production habitat improvement, and prescribed burning in the Main Boulder River Valley in the Big Timber District, and CNF plans aspen regeneration in the Beartooth District within the elk cumulative effects area. These projects will provide beneficial effects to wildlife by improvement of elk habitat. Aspen stand improvement will involve removal of decadent stands to promote suckering and rejuvenation. Browse habitat improvement and prescribed burning will be used to create openings in dense stands to promote winter browse production and provide greater habitat diversity. None of these projects will be located in the vicinity of the East Boulder Mine facilities, but they are within the range of the Main Boulder and Stillwater elk herds which also occur at the Placer Basin permit area. Populations of big game and many other species in the study area will benefit, including elk, deer, ruffed grouse, snowshoe hare, and perching birds.

GNF also plans mule deer winter range habitat improvement in the East Boulder River Valley. This will involve creation of scattered 1-5 acre openings to increase browse production and promote habitat diversity within unproductive stands of doghair Douglas fir and lodgepole pine. This project will directly benefit mule

deer along FS 205 accessing the mine site, by creating openings for browse production and by attracting deer away from the road. It will also benefit many other species which utilize forest openings and edge habitat.

Possible beaver reintroduction into the Main, East, and/or West Boulder Rivers will also provide beneficial impacts to wildlife. Beaver would help keep aspen and willow in a healthy, vigorous condition, create wet areas that would promote willows, trap sediment in ponds, create more biological diversity, and increase wetland habitat.

GNF plans several timber sales within the range of the Elk/Enos/Dry Fork elk herd. Generally, timber sales have the general result of removing overstory, resulting in an early successional stage. The long-term effects on elk and other big game species may be positive or negative, depending on the location of the harvest area (big game summer or winter range), the layout of the sale (size of opening, amount of edge, etc.) and the type of harvest. Forage for big game is usually increased for about 30 years following harvest, but loss of cover and increases in roads may have long-term adverse effects. Short-term adverse impacts may occur during the harvest period due to displacement of animals.

GNF plans to identify stands for timber harvest in the Upper and Lower Deer Creek area northeast of the project area, and firewood sales in the Lower Deer Creek area. Timber harvest in these areas would occur in mule deer and elk winter range. The projects are located in GNF subcompartments 108-02, 109-3, and 110-02. In 108-02 and 110-02 there have been little recent timber harvest or roading; consequently, a high HEI will be maintained under either larger or smaller harvest alternatives for subcompartment 108-02 and proposed harvest in 110-2. In subcompartment 109-3, which was partially affected by the recent Iron Mountain Timber Sale, the HEI would drop to 0.60 (below forest standards) for a larger timber sale (Option A), and to 0.69 (about at forest standard) for a smaller harvest (Option B). Timber harvest on 84 acres in Wright Gulch (subcompartment 112-01) would occur about 2 miles west of the East Boulder permit area, and south of road FS 205. Spring to fall use of this area by mule deer, elk, and black bear would be affected. HEI within subcompartment 112-01 would drop from 0.70 to 0.65 within the IRA, but would remain about the same at 0.69 when adjacent private land is considered. Elk use within this subcompartment is moderate. GNF also plans to remove about 100 acres of standing dead timber along road FS 205 in subcompartment 112-02 to reduce fire hazard. No roads would be constructed for this harvest. This initial analysis assumes all new roads would remain open, thereby reducing HEI by the greatest amount. Specific harvest and roading scenarios which can have varying effects on HEI will be analyzed at the project level through the NEPA process under proposed alternatives in order to determine an array of predicted effects.

Both GNF and CNF have proposed range improvement burns to eliminate timber encroachment in non-forested range. In addition, CNF plans to renovate 60 acres of meadows in the Picket Pin allotment. These projects are intended to improve livestock grazing, but may also affect wildlife by removing cover. Increases in forage would primarily benefit livestock.

Exploration drilling programs have been proposed by Pegasus and Pathfinder in the Big Timber District, and by Chrome Corporation (Mouat Mine and Crescent Creek/Iron Mountain Project), International Platinum (Picket Pin Project), SPGMR, and Hjelvik Bluebird Claim Group in the Beartooth District. Each of these ore exploration and evaluation projects would involve minor amounts of surface disturbance, ranging from 1/10 acre to 2-5 acres per year, and from 1 to 25 acres over the life of the project. It is not known whether any new roads are required for these projects. The largest of these projects, International Platinum's Picket Pin Project, will be located about 1.5 miles east of the Placer Basin permit area on the

East Boulder Plateau, and will affect important summer/fall elk habitat. The other projects are located near the existing Stillwater Mine and may affect elk and mule deer winter range, or are located in the Independence Mining District on the Main Boulder River. These projects will each result in behavioral disturbance to wildlife during periods of human activity, and will cause minor losses of habitat within the area occupied by the Stillwater and Main Boulder elk herds. In addition, continued expansion of the Stillwater Mine Project will involve about 100 acres of disturbance in addition to the 263 acres already occupied by facilities. Wildlife impacts will depend on the intensity, timing, duration, type of equipment, and number of people involved, which are not known at this time.

The cumulative impacts of these projects will involve generally minor losses of big game habitat in some areas, and improvement of habitat in others. Usually, wildlife habitat diversity will be improved, since much of the area is in an overmature, decadent condition with encroaching conifers due to fire suppression. Short-term disturbance to wildlife will occur from mining exploration activities at locations generally well-removed from the East Boulder Mine Project facilities. Increases in recreational activities, including hunting, will occur from increased human population in the area. Overall, big game populations and habitat are not expected to be affected in the long-term, although shifts in use patterns will occur. No cumulative adverse impacts are likely to occur to endangered or threatened species, or to non-game species.

## 4.7 AQUATIC ECOLOGY AND FISHERIES

### 4.7.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Road building and other earth moving activities are expected to add an additional 28 tons of sediment to the East Boulder River over 5 years. This impact will be minor because the amount of sediment delivered to the stream is less than 1 percent over natural of the sediment load previously carried by the river at the junction of the East Boulder River and Dry Fork. Predicted increased instream fine sediment would be extremely low and therefore is not expected to have an effect on aquatic biological communities. Other than sedimentation, no direct effects on aquatic habitats are expected. Fishing demand on the East Boulder River will likely drop below the level of existing use as local users will likely disperse themselves to other fishing areas (See Section 4.13.1). However, fishing pressure on other streams in the area is likely to increase due to increased human population.

### 4.7.2 Alternative 2 - Proposed Action

<u>Construction</u>. Potential impacts from construction include direct disturbance to aquatic habitats, sedimentation, changes in water quality, changes in fish passage, and changes in fishing pressure. However, none of the project facilities are expected to directly impact aquatic habitats, with the exception of a possible surface water diversion and bridge upgrades on the East Boulder Road (SG 31). A total of seven crossings may be upgraded, including one on the Main Boulder River, one across Elk Creek, and four on the East Boulder River. Some or all of this might occur as part of Alternative 1, as part of road upgrades required for exploration. Road and bridge construction in the river or on the banks would cause minor temporary losses of habitat and short-term increases in sediment. However, most of the river bed consists of boulders and rubble which are resistant to erosion.

Removal of vegetation and soil disturbance during construction within the permit area and along access roads would increase sediment yields to the East Boulder River. Predicted net sediment yields delivered overland to the stream resulting from all mine development, operation, and abandonment activities are predicted to be slight [5-7 percent over existing conditions (Section 4.2.2)]. Deposition of sediment is a concern because it can affect spawning success of salmonid fishes by smothering eggs and fry within the coarse gravels used for spawning. The predicted sediment yields are unlikely to have adverse impacts at the spawning areas for brown trout along the lower East Boulder River or for rainbow trout at small localized areas within the river. Suspended sediments can also affect aquatic life by interference with gill respiration and suspension of feeding and photosynthesis (Martin and Platts 1981). Predicted levels of suspended sediments in the East Boundary River would be too low (less than 1 percent) to have any direct adverse effects to fish or other aquatic organisms.

Construction of the facilities on the East Boulder Plateau is unlikely to cause any increase in sediment in the East Boulder River, because of the small size of the facilities and their remoteness from streams. The Brownlee Creek permit area is located adjacent to Brownlee Creek and the East Boulder River, and downstream from populations of the sensitive Yellowstone cutthroat trout. Evaluation of this area by GNF personnel (Zubik 1990b) suggested that sedimentation was unlikely to be a problem because of the large substrate size in the area and lack of potential sediment sources, if proper measures were used to minimize stream sediment input.

Spills of fuels, lubricants, or other hazardous materials into streams or onto soil adjacent to streams could adversely affect aquatic biota. Potential spills during construction would most likely be small and have localized effects. Potential types of spills and proposed prevention and control measures are described in Section 4.2.2.

Fishing pressure on area streams is likely to increase because of increased human population. A 1982 survey conducted by Western Analysis showed that nearly 60 percent of local residents said they fish; it is expected that the newcomers to the area would participate at approximately the same level. Nearly 50 percent of the Main Boulder River runs through private land and access is limited. The increased number of fishermen would therefore be concentrated on the readily accessible public fishing areas, creating a higher portion of anglers per mile of stream.

Operations. Potential additional impacts during operation include changes in water quality and water quantity from mine dewatering, spills and leaks, potential loss of aquatic habitat, unavoidable but minor losses of fish at the diversion, and the remote possibility of tailing pond dam failure.

Potable water would be provided by groundwater wells or by temporary surface water diversion of the East Boulder River. Withdrawal of either groundwater or surface water could affect aquatic habitats under low flow conditions in the East Boulder River between the withdrawal area and the influence of the percolation ponds. Under low flow conditions up to 10 percent of the streamflow may be diverted, which would reduce the amount of available aquatic habitat at this critical time. However, the stream length potentially subject to dewatering is only about 500 yards long, from the diversion point to the area where water from percolation ponds would enter the river. Operation of the surface water diversion (if used) may result in minor losses of fish or other aquatic organisms through entrainment or impingement. The intake structure would be designed to have intake velocities lower than fish escape speeds, and/or screening in order to minimize losses.

Withdrawal of water by a surface facility or from wells would be more than offset by discharge of mine water into percolation ponds which could increase the base flow in the East Boulder River. The resultant stream flow would meet all standards for a Class B-1 stream which are designed to protect aquatic life. Small increases in nitrates and phosphates may have a small fertilizing effect on the stream. The effects would be greatest under natural stream low flow conditions, when streamflow might be augmented by up to 25 percent. The projected increased flow of good quality water during normal periods of low flow should be generally beneficial to fish, benthic macroinvertebrates, and other aquatic organisms by reducing the amount of habitat loss due to drying during this critical period. Channel morphology is not expected to change.

Changes in water quality could potentially occur from spills and leaks of reagents, fuels, blasting compounds, tailing solution, or other materials as described in Section 4.2.2. Spills would be controlled by containment structures and berms, and are unlikely to directly affect aquatic habitat, which would be separated by a vegetated buffer of 200-400 feet between the East Boulder River and disturbed areas of the East Boulder permit area. Some of the reagents used in the mill are potentially toxic, but neither the process water nor the tailing solution would contain toxins in concentrations known to be harmful to fish. SPGMR would implement a monitoring program for surface and groundwater, as described in Section 2.3.19.4 and Section 2.5.5.

In the unlikely event of a tailing dam failure, large amounts of tailing could be deposited in the East Boulder River. Although the tailing material and solution do not appear to have any toxic constituents, large amounts of sediment would adversely affect or eliminate stream habitats for miles downstream. The sediment would destroy habitat for the periphyton, benthic macroinvertebrates, and fish. Coarse gravels and protected pools which provide important salmonid fish spawning habitat would be covered or filled. Rate of recovery would depend on depth of sediment, season flow rates, and stream gradient within the affected area.

Closure and Reclamation. Potential impacts during closure and reclamation would be similar to previous project phases. Increased sediment yield during reclamation would have minor impacts to aquatic habitats. Continued augmentation of low flows by mine water discharge into percolation pond would maintain low flow habitats established during the operation periods. Upgraded portions of FS 205 and FS 140 would remain open after closure of the mine, and would provide continued access to the East Boulder River Valley for recreational use, including fishing. It is uncertain whether fishing pressure on the East Boulder River would increase or decrease after mine closure, but fishing pressure in the area overall should increase.

### 4.7.3 Alternative 3 - Modified Tailing Impoundment Configuration

The modified tailing impoundment would occupy the same area as the proposed impoundment, and its construction, operation, and reclamation would have impacts similar to those described for Alternative 2. The potential for leakage/failure would be the same and the impacts would be the same.

### 4.7.4 Alternative 4 - Alternative Access Road/Power Line Alignments

Bench Route (R2). Construction and operation of the Bench Route would have only minor impacts to aquatic habitats since there would be only one stream crossing and most of the roads would be located on uplands away from the river. Potential impacts such as sedimentation and spills would be minor (Section 4.2.2). There would be no impacts on fishing access, since the old road would be maintained for

local use. No impacts would occur during mine closure and reclamation, since the upgraded road would be left in place.

Bench/Valley Route (R4). Use of the Bench/Valley Route would have similar impacts to use of the Bench Route. Additional minor impacts to aquatic habitats may occur from possible upgrade of one additional bridge and one mile of road in riparian habitat. Construction of the Bench/Valley Route would also have no impacts on fishing access, since the old road would be maintained for local use.

### 4.7.5 Alternative 5 - Power Supply Corridor Systems

Alternatives 5A and 5B from the existing Anaconda-Billings 161-kV transmission line to the Duck Creek Tap cross only intermittent or minor perennial streams. Segment 1 from McLeod to the lower end of road SG 31 crosses the Main Boulder River and would be upgraded. Sedimentation of streams and adverse impacts to aquatic habitats could occur if construction occurred in or adjacent to streams. Assuming avoidance of construction directly in streams and use of appropriate erosion control procedures for construction near streams, impacts on aquatic habitats and fisheries would be minor or not detectable.

### 4.7.6 Alternative 6 - Water Treatment Methods

Three methods are being considered for treatment of mine discharge water (Section 2.4.4) which would result in varying degrees of improvement in water quality in the East Boulder River (Section 4.2.6). Two of the alternatives which employ advanced water treatment techniques, 6a and 6b, would lower the potential for adverse impacts to aquatic communities. Alternative 6c and the Proposed Action have more potential to adversely impact aquatic life, primarily because they would increase nitrogen loads to the East Boulder River to a greater extent than would Alternatives 6a or 6b. The No-Action Alternative would assure no degradation to the river and no impacts to aquatic life from mine construction or operation activities.

### 4.7.7 Alternative 7 - Proposed Action with Modifications

Impacts on aquatic ecology and fisheries from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.7.2) with the exception of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce residual impacts to aquatic ecology and fisheries remaining after the application of the SPGMR's mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

East Boulder River. Analysis of SPGMR's plans for the potential use of surface water in mining and milling operations has raised concern that detrimental impacts could occur to the East Boulder River due to the unusually low flows or even flow disruption. For this reason, this alternative requires that minimum historic low flows of 5cfs in the East Boulder River must be maintained during the project period.

### 4.7.8 Alternative 8 - Twin Production Adits

Impacts to aquatic resources resulting from implementation of Alternative 8 would be similar to those described for Alternative 7 in Section 4.7.7 with the important exception that no habitat loss or impacts to Brownlee Creek would occur.

#### 4.7.9 Cumulative Impacts

Other projects potentially affecting aquatic habitat and fisheries in the Main Boulder River Valley include wildlife habitat and range improvements by GNF, beaver reintroduction to the Main Boulder River drainage, timber stand evaluation and potential harvest by GNF, and mining exploration activities. Each of these are described below.

GNF may implement aspen habitat improvement, browse production habitat improvement, and prescribed burning in the Main Boulder River Valley, and mule deer winter range improvement in the East Boulder Valley. These projects will involve creation of small openings in forested areas by cutting and burning. Short-term minor increases in sediments may occur in nearby streams, but the effects are likely to be limited by the small size of the openings.

Possible beaver reintroduction into the Main, East, and/or West Boulder Rivers would provide generally positive impacts to fisheries and habitat diversity by creating pools which trap sediment. Fish passage will not be affected since the local fish populations spawn in the spring during high flow periods and beaver dams are likely to be primarily on side channels, based on historic patterns.

The proposed timber harvest in the Wright-Gulch area and proposed removal of 100 acres of standing dead timber along road FS 205 is not likely to adversely affect aquatic habitat in the East Boulder River because the drainage is very erosion resistant, tributaries in the nearest areas are generally dry in summer, and this portion of the East Boulder River has a mixed species fishery with a higher limit for instream sediment (GNF 1991). If all proposed projects identified for Reasonable Foreseeable Development were implemented in the East Boulder over the ten-year period, instream fine sediment would only increase by an estimated 0.2 percent over existing conditions at the Forest Boundary (FS 1990b).

Several mining exploration projects are planned for the East Boulder and Main Boulder River drainages, including the Pegasus and Pathfinder projects in the Independence Mining District in the headwaters of the Main Boulder River, and International Platinum's Picket Pin Project east of the Placer Basin permit area. The Picket Pin Project would involve annual surface disturbance of 2-5 acres, and total disturbance of 10-25 acres over the life of the project. Requirements for the other projects are unknown at present, but are expected to involve less surface acreage disturbance. These projects might also cause minor increases in sedimentation.

The cumulative impacts of these projects may involve minor and short-term adverse impacts to water quality in the East Boulder and Main Boulder Rivers. However, no important changes in aquatic habitats or fisheries are likely to occur, with the exception of positive impacts through reintroduction of beaver. Increased human activity and populations in the area would cause increased recreational access, including increases in fishing pressure on a finite resource.

### 4.8 VEGETATION, WETLANDS, AND TIMBER RESOURCES

#### 4.8.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. This alternative will have those adverse effects on vegetation and timber resources associated with the removal of timber and/or vegetation necessary for the construction of the

exploration program's 18,500-foot adit, 1.0 mile of new access road, support facilities, percolation ponds, and waste rock stockpiles. The three percolation ponds will have a bottom area less than one acre in size. Approximately 30 acres will be removed from the timber base for the life of the exploration program.

The Jackpine Finding of No Significant Impact (FONSI) predicts that impacts on riparian communities will occur but does not identify these impacts. The most likely impacts will result from reconstruction of seven stream crossings on SG 31 which require removal of some streambank vegetation. Drainage from road surfaces will likely impact these areas by increasing erosion and reducing oxygen to riparian flora.

A small white-flowered forb, a form of yellow springbeauty, is a species of special concern. It is likely that some individual plants have been already been destroyed by exploration activities. However, exploration activities will cover less than 30 acres, which represent a very small portion of this plant's local distribution (Lesica 1990). Viable populations of this yellow springbeauty should remain intact throughout the area.

Sites disturbed for construction are susceptible to weed infestation. Drier, rockier, and lower elevation sites are most susceptible. SPGMR is aware of the potential for weed invasion on disturbed sites. SPGMR is committed to the control of weeds on a regular basis as necessary and has indicated a willingness to work with Sweet Grass County on a weed control plan.

The Jackpine FONSI and Settlement Agreement include a reclamation plan for disturbed sites which meet federal and state standards. Reclamation is planned for on- and off-site damage and involves "reshaping and revegetation of the disturbed areas, where reasonably practicable, and rehabilitation of fisheries and wildlife habitat if necessary."

#### 4.8.2 Alternative 2 - Proposed Action

The alternative is the SPGMR proposal and would remove vegetation from 233 acres. These sites are included in the East Boulder, Brownlee Creek, and Placer Basin permit areas and along road and power line routes. Approximately 50 acres would be disturbed by road construction and road improvements.

<u>East Boulder Permit Area</u>. The East Boulder permit area would include the adit and mine support facilities. This permit area is 260 acres of which 200 acres would be physically disturbed.

The habitat types that would be impacted by vegetation removal are subalpine fir/pinegrass and subalpine fir/grouse whortleberry/pinegrass types (Beak 1982c). About 70 acres of the overstory have already been removed for exploration activities, posts and poles, and construction of the weather station, roads, etc. (England 1992). The tailing impoundment would cover approximately 105 acres. At project completion, the impoundment would be reclaimed if possible to provide wildlife habitat. SPGMR plans call for removal of all mine-related facilities, but the company is willing to consider leaving certain facilities, especially buildings, if this is considered beneficial.

No site construction activities are planned in riparian and wetland areas, with the exception of road and bridge work. Minor impacts may occur from runoff containing sediments or chemicals if this runoff enters riparian and wetland sites. The permit area extends north to intersect the East Boulder River and, in two small sections it actually crosses the stream. The current bridge which accesses the Dry Fork would be utilized in the future with no further construction activities.

Seven existing stream crossings would be upgraded with larger structures. This reconstruction would require minor disturbance of riparian and wetland vegetation. Bridge upgrades would likely occur during exploration activities and have been approved as part of the Jackpine Exploration Project.

The reclamation efforts proposed in this alternative focus on post-mining landscape planning. The stated goal of reclamation is to revegetate to native species and provide wildlife habitat, principally for mule deer. Some areas would be reclaimed and revegetated during the life of the project. These include soil stockpiles, percolation pond embankments, drainage and diversion ditches, cut and fill slopes, and borrow pits. Areas revegetated and reclaimed during mine operation would be evaluated on an on-going basis. The knowledge gained during this reclamation and evaluation process would be utilized for the final closure reclamation.

Concern over impacts to the sensitive plant species Claytonia lanceolata var. flava prompted a survey for the species in the East, Main, and West Boulder River drainages (Schassberger Roe 1991). This survey was conducted in June 1991, by the Montana Natural Heritage Program. Numerous large populations and subpopulations were located in the East Boulder River drainage on both Forest Service and private lands.

Construction of the tailing impoundment and other development within the East Boulder permit area would eliminate four subpopulations; two containing approximately 1,000 plants each, and two smaller subpopulations containing 5 and 50 plants respectively. However, other large populations were found both above and below the East Boulder permit area, several of which contain tens of thousands of plants. These populations would not be impacted by the mine. In addition, several small populations were found along the Main Boulder River and one small and one large population were found along the West Boulder River. Claytonia lanceolata var. flava is also known to occur in other areas of the Gallatin National Forest and in other parts of Montana. As a result of this survey, the Montana Natural Heritage Program state rank for the species will change from S1 (critically imperiled in Montana because of extreme rarity, 5 or fewer occurrences) to S3 (rare in Montana, 21 to 100 occurrences). While development and operation of the East Boulder Mine would eliminate those individuals in the East Boulder permit area, the mine would not likely pose a threat to the continued existence of this species in the East Boulder River drainage.

The road system proposed under this alternative includes 2.6 miles of new road construction and upgrades for 25 miles of existing road. The upgraded sections of road utilized by the public after closure would not be reclaimed. Roads determined by the U.S. Forest Service to be non-beneficial to the public or not in compliance with forest management objectives would be recontoured and seeded to the appropriate species mix.

All disturbed sites have potential for weed invasion. The most likely weed candidates are those common to the area, including leafy spurge and Canada thistle. Spotted knapweed may also invade these sites due to its widespread distribution across the state and its ease of transport by vehicles. Other potential weed problems include hound's tongue, musk thistle, burdock, and others. This alternative addresses the Montana County Noxious Weed Control Act through a SPGMR commitment to pursue an active weed control program in conjunction with Sweet Grass County.

This alternative would remove approximately 200 acres of timber for the life of the mine and tree development period. GNF is proposing to reclassify the area from Management Area 8 (timber emphasis) to Management Area 24 (mining emphasis). The Draft Stillwater Complex Integrated Resource Analysis suggests an additional 100 acres of timber (lodge pole pine) would be harvested from compartments 112 and 115 if the SPGMR permit is approved.

Brownlee Creek Permit Area. At the Brownlee Creek permit area, 3 of the 4 permit acres would be disturbed. The principle habitat type at this site is subalpine fir/grouse whortleberry, although a major portion of this area is mapped as scree. No roads would be constructed to this site.

This permit area boundary abuts both Brownlee Creek and the East Boulder River. Creek-side riparian and wetland vegetation may be locally impacted depending on the amount of surface disturbance, the proximity of disturbance to the wetland/riparian area, and the type of drainage controls installed. Impacts to riparian/wetland vegetation could result from runoff carrying sediments or chemicals into the surface drainages which could inhibit photosynthesis or other biological processes and reduce plant viability. However, easily eroded sediments are not readily available in this area so stream siltation should not occur. SPGMR's commitment to use best management practices would also help to alleviate concerns over runoff problems. Finally, no chemicals have been identified for use in this area which would present a problem to vegetation.

No commercial timber exists at this location.

Weed infestation is dependent on a seed source and suitable seedbed and site conditions. The potential for invasion of weeds on this site is low since no road system would be utilized for transportation. This reduces the availability of weed seeds, although a low possibility exists that weeds could still be transported by miners, helicopters, or some other method.

With sufficient soil availability, scree sites could be easily reclaimed to scree with nutrients and the appropriate vegetative mix. Since no soil is available for stockpiling in this permit area, reclamation success is expected to be much more difficult. Alternative methods for reclamation would need to be determined, or plans developed for soil importation to use in reclamation procedures.

Placer Basin Permit Area. The Placer Basin permit area is the largest of the three permit areas. It includes 580 acres, of which 30 have been previously disturbed. Most disturbance would occur near the Frog Pond adit. Current vegetation at the Frog Pond adit is dominated by the subalpine fir-whitebark pine/grouse whortleberry habitat type.

The riparian/wetland inventory did not include this permit area, but small patches of riparian/wetland are expected to occur in swales and depressions. Negative impacts to this area would occur if roads or other facilities are constructed on or very near riparian/wetland sites such that erosion and sedimentation fills in riparian/wetland locations or is of sufficient quantity to reduce oxygen availability and photosynthetic functions. Use of BMPs should help to minimize this potential.

No commercial timber occurs in this permit area.

Road and facilities construction would create an opportunity for weed establishment by exposing bare soil. Significant weed infestations are unlikely in this permit area due to the cold climate.

The success or failure of reclamation is dependent on the amount and quality of soil available, the applicability of species selected for revegetation, seedbed preparation, and post reclamation disturbance such as erosion, fire, or grazing. SPGMR has identified appropriate species for revegetation and methods for reclamation of disturbed areas. Approximately 9,000 $yd^3$ of salvageable soils have been identified in this area which should provide a suitable stockpile

#### 4.8.3 Alternative 3 - Modified Tailing Impoundment Configuration

This alternative configuration is almost identical to the proposed action except the slope of the tailing impoundment would be less steep; (2(H):1(V) instead of 1.6(H):1(V)). The modified tailing dam face would be more easily reclaimed through the use of rock armor strips and a mosaic vegetation scheme.

#### 4.8.4 Alternative 4 - Alternative Access Road/Power Line Alignments

This alternative is almost identical to Alternative 2 except for changes in access roads. The difference between the Bench Route (R2) and the Bench/Valley Route (R4) is a one-mile long section of road in Sections 33 and 4 (Figure 2.4-2).

Both road locations would result in approximately 6 miles of new road construction or upgrade. This option would include disturbance of cropland, rangeland, pasture, and meadow along part of route.

Both roads would also intersect a series of wetlands, identified in Subsection 3.8. New road construction would have 2 or 3 new stream crossings. Two of the three crossings are on intermittent drainages and may not require a bridge. The Bench Route has one less stream crossing than the Bench/Valley Route.

- Big Timber is developing annexation and facilities plans for several parcels outside city limits which have been zoned residential; this extraterritorial zoning is interim zoning which would expire at the end of calendar 1993 if the parcels are not developed.

Drainage for road construction may reduce wetland area size depending on specific construction plans which are as yet undeveloped. Loss of wetlands, if approved for road construction, would likely require replacement to ensure no net loss in accordance with Presidential policy.

Disturbed areas may be colonized by weeds. Disturbances along roads and powerlines would be especially prone to weed invasion due to available seed source and favorable climate. It is likely that some weed infestation would occur as a result of new road development, although weed control procedures would reduce the spread and possibly eliminate specific colonies. This impact can be especially detrimental to nearby agricultural and range lands.

#### 4.8.5 Alternative 5 - Power Supply Corridor Systems

Construction of a new power line to the East Boulder permit area would disturb vegetation along the route and where temporary roads are utilized for tower construction. There will be approximately 25-mile corridor for the new powerline.

The rangeland communities and productive agricultural lands disturbed by construction of either system would be removed only temporarily from productive use except where cultural practices such as irrigation are attached. Immediate revegetation could improve the production on some range sites.

The disturbance associated with the construction of a new powerline could create an opening for weeds to become established. Disturbances along roads and powerlines would be especially prone to weed invasion due to available seed source and favorable climate. As noted in Alternative 4, implementation of weed control procedures would help to reduce the spread of noxious weeds. However, impacts of weed infestation can be serious in this area because the current land use is agricultural and/or grazing.

### 4.8.6 Alternative 6 - Water Treatment Alternatives

No additional impacts beyond those impacts described in Section 4.8.2 would result from implementation of one of the water treatment alternatives.

### 4.8.7 Alternative 7 - Proposed Action with Modifications

Impacts on vegetation, wetlands, and timber resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.8.2) with the exception of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce or eliminate residual impacts to these resources remaining after the application of SPGMR's mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Tailing Impoundment Reclamation. Vegetation to be established on the tailing impoundment must be selected based on achieving acceptable biological diversity and ability to provide visual screening in addition to stabilizing the soil surface. The establishment of a diverse stand of vegetation on the reclaimed tailing impoundment would enhance the long-term maintenance of a protective vegetative cover on this sensitive facility. These mitigations would help ensure that post-reclamation land management objectives are met as well as reduce the visual impact of the tailing impoundment on the surrounding environment (See Section 4.12-7).

Wildlife. The establishment of unpalatable plant species in disturbed areas adjacent to roads would likely reduce the potential for wildlife roadkills.

Visuals. Because development of the mine facilities would not meet GNF visual quality objectives, a vegetation management program would be implemented where visual (or noise) quality standards are exceeded. Locations where this program may be required include: the area between FS 205 and the East Boulder campground; the millsite; and the tailing impoundment and plateau areas.

Wetlands. The avoidance of construction including dredging or backfilling in wetland/riparian communities would help ensure compliance with Presidential Executive Order 11990 requiring "no net loss of wetlands." Avoidance is considered by the agencies to be possible for all aspects of this project, with the exception of the installation of new bridges or upgrade of existing structures. Best management practices must be followed to minimize impacts associated with these activities.

East Boulder Plateau. Breakouts on the East Boulder Plateau (Placer Basin permit area), scheduled to occur throughout the life of the mine, would be approved by DSL and GNF prior to constreuction. A vegetation survey including wetlands analysis would be conducted prior to approval of breakouts as deemed necessary by the agencies. Breakouts would be designed to avoid adverse impact to wetlands.

### 4.8.8 Alternative 8 - Twin Production Adits

Impacts to vegetation, wetlands and timber resources resulting from implementation of Alternative 8 would be similar to those described for Alternative 7 in Section 4.8.7 with the important exception that no habitat loss or impacts to Brownlee Creek would occur. All four acres of subalpine fir/grouse whortleberry habitat would remain undisturbed.

### 4.8.9 Cumulative Impacts

Cumulative impacts resulting from this project in addition to other GNF projects should not have substantial additional impacts on vegetation. No plant species of special concern would be eliminated. No cumulative effects would lead to substantial changes in widespread vegetation patterns for any plant community including wetland/riparian types. The spread of noxious weeds and weed control efforts would not be altered substantially by the cumulative effects of this project. Cumulative effects associated with additional timber removal were discussed in Section 4.8.2, and would be addressed in the Forest Service area management plans.

## 4.9 AIR QUALITY

### 4.9.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. During the exploration program, particulate and gaseous emissions will result from the following exploration activities and electrical power generation:

- Ore stockpiling
- Soil stockpiling
- Exposed disturbed areas
- Waste rock dumping
- Vehicle operations on unpaved roads
- Diesel exhaust from vehicles or generators
- Electrical power generation

Particulate emissions will result from the above listed exploration activities. Using emission factors developed by the EPA (EPA 1985), the total particulate and respirable particulate (PM-10) emission from these sources were estimated as 13.1 tons per year (tpy) and 9.0 tpy, respectively.

Gaseous emissions generated from the propane-powered electrical generator were estimated as 15.0 tons per year (tpy) of hydrocarbons, 131.0 tpy of carbon monoxide, and 65.0 tpy of nitrogen oxides. It is anticipated that this generator will be in operation for 1 to 2 years until construction and upgrading of power transmission lines are completed to the mine and mill site (Alternative 2).

The impacts from the operation phase of this alternative were estimated using the EPA Valley Dispersion Model. The Valley Model was used to predict the annual and 24-hour impacts using on-site meteorological data for the annual period and hypothetical worst-case meteorological data for the 24-hour period. The modeling results indicate a maximum annual and 24-hour PM-10 impacts of 6.0 $\mu g/m^3$ and 6.8 $\mu g/m^3$,

respectively. These concentrations are well below the Federal and Montana PM-10 ambient standards of 150 $\mu g/m^3$ and 50 $\mu g/m^3$ for the 24-hour and annual periods, respectively.

The oxides of nitrogen impacts were estimated in the Valley Model as 16.9 $\mu g/m^3$ for the annual period. This value is well below the PSD Class II nitrogen dioxide increment of 25 $\mu g/m^3$ and the annual Montana and Federal standard of 100 $\mu g/m^3$ (0.053 ppm). The emissions and impacts described above relative to on-site power generation are based on the original proposal. SPGMR has recently proposed some changes to allow flexibility in the type of electrical generation to be used. This will result in a slight increase in emissions, primarily nitrogen oxides. The limiting factor will be the allowable Class II nitrogen dioxide increment of 25 $\mu g/m^3$.

The Air Quality Bureau has issued a Preliminary Determination on the air quality permit application for the project. The analysis portion of the Preliminary Determination includes a complete emission inventory for the project, a description of applicable regulations, summaries of impact analyses (computer modeling), a description of ambient air monitoring requirements, and a discussion of specific concerns which have been raised, such as road dust along the access road.

The Preliminary Determination is included as Appendix C. The comment period for the Preliminary Determination will coincide with the comment period on the draft EIS. Questions concerning the Preliminary Determination should be directed to the Air Quality Bureau at (406) 444-3454.

Closure and Reclamation. Short-term air quality impacts would result from closure and reclamation activities. Particulate and gaseous emissions would be generated by construction vehicles, but the associated impacts are considered to be minimal given the mitigation measures required. Air quality standards would likely not be exceeded.

### 4.9.2 Alternative 2 - Proposed Action

Construction. Air quality impacts from construction activities would be short-term and would result from construction of the tailing impoundment and various mine and mill facilities at the East Boulder permit area and adits/ventilation breakouts in the Placer Basin and Brownlee Creek permit areas. Particulate and gaseous emissions would be generated by construction vehicles and implements and the continued operation of the electrical generator (Alternative 1) until the completion of electrical power line construction/upgrading to the mine and mill site.

Gaseous emissions generated from the electrical generator were estimated as 15.0 tpy of hydrocarbons, 131.0 tpy of carbon monoxide, and 65.0 tpy of nitrogen oxides. It is anticipated that this generator would be in operation for 1 to 2 years through construction and into operation phase, until the power transmission lines are completed.

The oxides of nitrogen impacts from the electrical generator and vehicle exhaust were estimated in the Valley Model as 24.1 $\mu g/m^3$ for the annual period This value is below the PSD Class II nitrogen dioxide increment of 25 $\mu g/m^3$ and the annual Montana and Federal standard of 100 $\mu g/m^3$ (0.053 ppm).

Operation. During the operation phase of this alternative, particulate and gaseous emissions would result from the following mining and milling processes:

- Ore stockpiling
- Ore processing
- Soil removal, loading, dumping, and stockpiling
- Exposed Disturbed areas
- Waste rock hauling and dumping
- Vehicle operations on access roads
- Road maintenance

Particulate matter emissions from the mining operation and use of access roads would be primarily fugitive dust. The major activities which would generate particulate matter emissions in the processing of ore would be primarily in dry handling of ore from placement in the ore stockpile through crushing and screening, at which point the ore would be fed into the enclosed mill circuit. Within the mill circuit, the process would be totally wet and no particulate emissions would occur. Using emission factors developed by the EPA (EPA 1985), the controlled total particulate and PM-10 emissions were estimated as 63.8 tpy and 49.9 tpy, respectively.

The impacts from the operation phase of this alternative were estimated using the EPA Valley Dispersion Model (Gelhaus 1990). The Valley Model was used to simulate the annual and 24-hour impacts using on-site meteorological data for the annual period and hypothetical worst-case meteorological data for the 24-hour period. The modeling results indicate a maximum annual PM-10 impact of 9.4 $\mu g/m^3$ and maximum 24-hour PM-10 impact of 16.5 $\mu g/m^3$. These values are well below the Montana and Federal annual and 24-hour PM-10 standards 50 $\mu g/m^3$ and 150 $\mu g/m^3$, respectively.

A visibility screening analysis was performed using the Viscreen model and SPGMR emissions data. Viscreen is a computer model based on methods outlined in the "Workbook for Plume Visual Impact Screening and Analysis" (EPA 1988). The model was run using emission values of 0.130 metric ton per day of PM-10, 0.011 metric ton per day of sulfur dioxide, and 0.258 metric ton per day of nitrogen dioxide. The distance from the project location to the closest wilderness boundary of 11 km and the background visual range of 110 km were also used as input to the model. The modeling results indicated contrast values between the plume and the sky, between the plume and the terrain, and between the sky and the terrain were all less than 0.1. Since this screening threshold of 0.1 was not exceeded for any of the contrast values, it is highly unlikely that the emissions from the East Boulder Mine Project would cause visibility impairment to the Absaroka-Beartooth Wilderness.

The potential exists for PM-10 impacts resulting from wind erosion of the tailing impoundment if it is allowed to dry. However, the impoundment would be designed so that the majority of the tailing surface would be submerged under water, preventing the potential wind erosion problem.

Closure and Reclamation. Minimal short-term air quality impacts would result from closure and reclamation activities. Particulate and gaseous emissions would be generated by the operation of vehicles, but air quality standards would likely not be exceeded especially if mitigation measures contained in the Preliminary Determination (Appendix C) were adhered to.

### 4.9.3 Alternative 3 - Modified Tailing Impoundment Configuration

This alternative consists of the construction, operation, and closure of the modified tailing impoundment facility. Impacts resulting from the implementation of this alternative configuration are expected to be similar to implementation of the tailing dam configuration described in Alternative 2.

### 4.9.4 Alternative 4 - Alternative Access Road/Power Line Alignments

The air quality impacts for the Bench Route and the Bench/Valley Route would be similar. Impacts are discussed below.

Construction. Temporary air quality impacts would result from the construction or improvement of the Bench Route and the Bench/Valley Route access roads. Construction vehicles would produce particulate and gaseous emissions. Given the proposed mitigation measures in the Preliminary Determination (Appendix C), these impacts would be minimal.

Operations. Use of an alternative access road would cause air quality impacts similar in magnitude to those associated with the use of the existing road. However, the impact would be at a greater distance from residences and should therefore be reduced in effect on the human population. The significance of these impacts is dependant primarily on the effectiveness of the dust control measures described in Section 4.9.6.

Closure and Reclamation. No additional negative air quality impacts would result from closure activities as the access road would be left in place for future use. It is projected that road use would decline substantially after mine operations cease, so air quality would likely improve.

### 4.9.5 Alternative 5 - Power Supply Corridor Systems

The air quality impacts for each power corridor alternative would be similar. Impacts are discussed below.

Construction. Temporary air quality impacts would result from land clearing and construction of the power corridors. Construction vehicles would produce particulate and gaseous emissions. These impacts would be minimal if done in compliance with mitigation requirements (Appendix C) and best management practices, and air quality standards should not be exceeded.

Operations. No air quality impacts would result from the operation of the power transmission systems, other than very minor additional vehicle emissions associated with powerline maintenance activities.

Closure and Reclamation. No air quality impacts would result from closure of the power transmission systems; it is anticipated that the electric utility would not in fact abandon the system upon mine closure.

### 4.9.6 Alternative 6 - Water Treatment Alternatives

Implementation of any of the water treatment alternatives would have no measurable impact beyond those described for Alternative 2 in Section 4.9.2. Treatment facilities would be powered by electricity.

### 4.9.7 Alternative 7 - Proposed Action with Modifications

The mitigation measures outlined in Section 2.5 which would mitigate impacts of the proposed action on air quality are those concerned with road management and dust control. This includes mitigation measures found in the air quality permit Preliminary Determination (Appendix C). Common dust control techniques for unpaved roads include paving, treating the surface with penetrating chemicals, watering, and maintaining control of traffic volumes and speeds. Control efficiencies for these mitigation measures typically range from 50 to 85 percent (EPA 1985). These mitigations would help ensure air quality standards are not violated during construction, operations, or closure and reclamation activities.

### 4.9.8 Alternative 8 - Twin Production Adits

Impacts to air quality resulting from implementation of Alternative 8 are projected to be slightly different than those described in Alternative 7 primarily because power demands for adit development would be reduced due to the smaller size boring machine. Emissions from, for instance, on-site generators should be less. On the other hand, more tunnel would be drilled for twin production adits, resulting in more waste rock and possibly greater dust or particulate emissions. SPGMR has notified Department of State Lands (SPGMR, 5/31/91) that emissions are expected to be within the levels permitted and modeled as part of SPGMR's exploration air quality permit and proposed production air quality permit. No baseline information concerning emissions generated as part of Alternative 8 was submitted for review, so the assumption of permit compliance is not verified in this impacts analysis.

### 4.9.9 Cumulative Impacts

Cumulative impacts were assessed by adding the PM-10 impacts predicted by the model to the measured background data. For Alternative 1, the cumulative annual PM-10 impact is 15.0 $\mu g/m^3$, and the cumulative 24-hour PM-10 impact is 41.8 $\mu g/m^3$. For Alternative 2, the cumulative annual PM-10 impact is 18.4 $\mu g/m^3$ and the cumulative 24-hour impact is 51.5 $\mu g/m^3$. These values are well below the Montana and Federal PM-10 ambient standards of 50 $\mu g/m^3$ and 150 $\mu g/m^3$ for the annual and 24-hour periods, respectively.

It is possible that vehicular traffic from other projects such as mineral exploration or logging would increase air quality impacts along the access roads. However, no other projects are anticipated to occur in the vicinity of the East Boulder Mine Project area which would contribute to air quality degradation.

## 4.10 TRANSPORTATION

The transportation analysis in the draft EIS was based upon SPGMR's original traffic projections which assumed 2.5 employees per vehicle during operations. Since then, SPGMR has committed to a bussing program where approximately 80 percent of the work force would access the mine site via bus. Bus capacity would be between 40 and 60 passengers. The transportation analysis has been reworked in the final EIS to reflect SPGMR's commitment to bussing.

The following paragraph provides a discussion of condemnation authority which is also provided in Chapter Two. The purpose of this discussion is to acknowledge that there would be environmental and human impacts resulting from implementation of any of the road alternatives, and it is possible that condemnation authority would be invoked to provide safe access to the mine.

Federal and state condemnation laws may or may not apply to this mine project. Condemnation authority can lie with the county or the mining company and is dependent upon site-specific circumstances. The county authority might be used to widen the existing road or to gain a new right-of-way. The company authority could only be used if (1) the taking were necessary, that is, there were no other route; and (2) the route chosen was consistent with the greatest good and safety, resulting in the least private injury.

Site-specific circumstances influence condemnation decisions under the various statutes. The interpretation of those circumstances and statues is the role of the judicial system. Inverse condemnation can only be used against those who have condemnation powers.

### 4.10.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Impacts resulting from these exploration activities include the generation of increased dust and noise to the residences located along SG 31, and to a lesser extent increased noise to residences along FAS 298. These impacts are a result of the construction activities resulting from road upgrades and increased traffic associated with exploration activities. A small increase of road wear will likely occur to FAS 298 from the increased traffic. More wear of SG 31 and FS 205 is expected due to the size and weight of vehicles used during mine exploration. These impacts will likely be short-term. For the Placer Basin permit area there will also be minor, short-term impacts with a small increase of use on FS 140.

### 4.10.2 Alternative 2 - Proposed Action

Construction. Average daily traffic (ADT is the total volume of traffic for both directions, over a 24-hour period, at a given location on the roadway) for the section of FAS 298 between Big Timber and McLeod averaged 600 and 189 at the edge of each town, respectively, in 1989 (Montana Department of Highways 1990). Current traffic projections estimate that during the first year construction period, ADT would increase by 258. In other words, the number of vehicles passing by a particular road location would increase by 258 each day. Construction traffic would result in a 43 percent and 137 percent increase at the Big Timber and McLeod locations, respectively.

ADT on SG 31 at the Main Boulder River bridge has been estimated to be 90 ADT for 1989. During mine construction, ADT would increase to 348. This would represent a 286 percent increase. SG 31 has reported design deficiencies which could affect its safe and efficient use by local residents, mine traffic, recreational, agricultural, and forestry users (HKM Associates 1990). A substantial amount of work would have to be done in order to bring the existing road up to modern safety and functional standards. A certain amount of horizontal and vertical road re-engineering and realignment would be required. All of the seven bridges on SG 31 would require either replacement or reconstruction to accommodate the heaviest anticipated loads associated with the proposed project. During bridge replacement, short-term adverse effects of sedimentation to the East Boulder River would occur.

At the GNF boundary, SG 31 becomes FS 205. This road would also require improvement to handle the increased traffic. ADT for 1989 averaged about 18 from May to November. ADT would increase to 276 during construction. This would represent a 1,433 percent increase in ADT. The Forest Service recommends that roads which receive ADT volumes greater than 200 be paved because at that level of traffic volumes the cost of maintenance on a gravel road is at least equal to, and more often exceeds, the cost of a paved road. A gravel road may be acceptable; however, it must receive the necessary maintenance to keep

the road up to certain quality standards to be determined by the Forest Service. Since ADT at operations is expected to be less than 200 due to the implementation of a bussing plan, FS205 would most likely not be paved. The road which is constructed would be a double-laned graveled roadway, approximately 24-feet wide, including shoulders. Forest Service engineers have examined the existing road and feel that with some minor realignment and general widening of the route, it can be brought up to the necessary standards. Actual specifications for the road have not yet been designed. SPGMR would be responsible for costs associated with both construction and maintenance of the road according to Forest Service standards, commensurate with their share of use. Improvement of the existing FS 205 road is considered to be the only acceptable alternative for providing improved access to the project site.

Access to the developed recreation trail system, including Dry Fork, through the designated permit area would not be blocked. Minimal impact is expected to Roadless Area No. 1-371.

Operations. Similar types of impacts described under construction would occur during operations. With bussing, an increase of 170 ADT is estimated, resulting in an increase in maintenance costs and accident rates. For the years 1986 through 1989, the 16.8 mile segment of FAS 298, the accident rate per million vehicle miles has averaged 1.20 (Montana Dept. of Highways 1990). At operations, there would be an additional 1,042,440 vehicle miles (16.8 [segment length] x 170 [ADT] x 365 days) per year. Based on accident rates from previous years, this increase would result in approximately 1.25 more accidents, accidents with injuries, and increased fatalities. An increase in ADT of 170 would increase traffic volumes on FAS 298 to 359 ADT (90% increase), on SG31 to 260 (189% increase), and on FS 205 to 188 (944% increase).

The Valley or existing route has a number of private intersections whereby local landowners gain access to their residences or property. Increasing numbers of access locations represent greater potential for accidents. A number of curves on the existing route would need to be reconfigured to provide safe driving conditions for two-way traffic. This effort would likely require right-of-way on private property adjoining the road in some areas. Approximately 12 curves on the Valley route were judged by SPGMR's engineering consultant to be "sharp" (HKM 1990). The Valley route has areas of relatively steep shoulder slope which are not considered as safe as a designed shoulder fill proportion of 5 feet horizontal to 1 foot vertical.

Finally, and possibly most importantly, the Valley route is sited in close proximity to a number of residences in the East Boulder River Valley. The impacts of increased traffic on these residents in terms of noise, air quality, and safety considerations are considered major.

Closure and Reclamation. For this phase, the ADTs related to mining activity would cease. Road improvements would likely remain. The accident rate would probably return to the present rate. Indirect effects of mine traffic on nearby residents would also cease.

### 4.10.3 Alternative 3 - Modified Tailing Impoundment Configuration

The alternative tailing impoundment configuration would not change any effects already described in Alternative 2.

### 4.10.4 Alternative 4 - Alternative Access Road/Power Line Alignments

Alternative routes include the Bench (R2) and Bench/Valley (R4) routes (Figure 2.4-2). These routes are approximate locations and show possible routes, not exact placement, which would be determined in a final design phase. Each of these alternative routes is located on the west side of the East Boulder River because of the suitability of the bench type terrain for road construction and because a road on this side of the river would require fewer river crossings.

For purposes of comparison, the existing SG 31 would be upgraded to the same standards as proposed for the new alternative routes. The new road would be approximately 30 feet wide with a gravel surface, producing a safe and efficient road for 40 mph design speeds. Curves would not have a radius less than 465 ft with a posted speed limit of 35 mph. These basic standards are assumed for all alternatives.

The southern end of the Bench Route would start at the GNF boundary and coincide with the existing road for approximately ¼ mile, where it would turn west and follow an alignment through irrigated land, east of the Mason ditch. The route would gradually ascend a moderate slope reaching the elevation of the top of the bench. The road would be kept as close to the easterly edge of the bench as possible within geotechnical engineering standards. Further detailed geotechnical investigations would be carried out before any Bench Route construction plan is prepared, to study possible future hillside slope failure. The route would then turn northwesterly and run uphill for about 0.62 miles, where it would then head north to the common point with the Bench/Valley Route. From the junction north to Highway 298, the Bench Route would coincide with the existing road.

The Bench/Valley Route would be the same as the Bench Route from the southern end to the point where the Bench Route turns uphill, leaving the east side of the bench (Figure 2.4-2). In this area, there would be an interconnection to the Valley Route at the locations of the existing Boe bridge. North to FAS 298, the existing SG 31 would be used. A brief discussion of the problems associated with each route (Bench, and Bench/Valley) follows.

The Bench Route would have two public road intersections and eight ranch entrances, while the Bench/Valley Route would have two public intersections and nine ranch entrances. Each intersection or entrance increases safety concerns. The Bench Route would likely have no sharp curves, while the Bench/Valley Route would be assumed to have two, somewhat decreasing the relative safety of that route compared to the Bench. The placement of the two routes primarily on a bench would increase concerns about traffic safety during winter storms and blizzard conditions, since there would be little shelter from winds and blowing snow. Both the Bench and Bench/Valley Routes would cross areas where engineering considerations for saturated soils would be required. Swampy areas associated with ponded rainfall and irrigation water would need drainage so as not to induce road foundation failure. It is the agencies' assessment that wetlands could be avoided for both of these routes.

### 4.10.5 Alternative 5 - Power Supply Corridor Systems

Vehicular transportation roads or routes would not be affected by construction, operation, or closure of electrical power line construction or upgrading.

#### 4.10.6 Alternative 6 - Water Treatment Alternatives

Implementation of any of the water treatment alternatives would result in minimal increases in vehicle traffic during construction and operations. Traffic to and from the East Boulder permit area would continue for the life of the mine wastewater treatment program.

#### 4.10.7 Alternative 7 - Proposed Action with Modifications

Impacts to transportation from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.10.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by DSL and GNF in this alternative would effectively reduce or eliminate residual transportation impacts remaining after the application of the mitigation program. The impacts to be mitigated under this alternative are identified below.

- Details on the proposed bussing program such as identification of suitable staging area(s) in Big Timber and/or other locations for buses to pick up workers and materials would be submitted to the agencies when the information becomes available.

- Establishment of a maintenance agreement with Sweet Grass County prior to project implementation addressing such issues as road management, vegetation control, standards for upkeep, dust control, snow removal, runoff and erosion control, etc.

- Agencies' review and approval of final road design and road modification for FS205 prior to project implementation.

- Agencies' field review and approval of road route prior to construction.

- Identification of standards for roads on private lands.

- A plan for final road reclamation on private lands must be developed and approved if an alternate road alignment is chosen and the road is not being proposed as a permanent county or public road.

- Construction on un-improved roads for powerline development would be restricted during wet periods when soils are subject to rutting and erosion. Temporary roads would be revegetated when construction is complete.

- Employee parking would not be allowed outside the East Boulder permit boundary on U.S. Forest Service managed lands.

- Roads constructed or upgraded on public lands which serve no beneficial post-mining purpose should be ripped, recontoured, supplied with additional soil, and seeded as deemed appropriate by state and local agencies.

- If chemical dust suppressants are to be used on roads, SPGMR would provide a list of the dust retardants and material safety data sheets to the Forest Service for review and approval. Application of approved dust suppressants would be made in amounts only sufficient to suppress dust, and the application would be made by a licensed, bonded applier. (In addition, SPGMR would develop procedures for training personnel on the proper use of dust control chemicals or use the services of a trained and licensed contractor).

- Plowed roads must be signed forbidding snowmobiling.

### 4.10.8 Alternative 8 - Twin Production Adits

Transportation requirements and impacts are not expected to be different from the Proposed Action with Modifications (Alternative 7) if Alternative 8 is implemented.

### 4.10.9 Cumulative Impacts

The additive effective cause by reasonably foreseeable projects and activities on transportation generally would be minor. However, during particular projects such as a timber sale, an increase in log hauling trucks and logging related truck traffic would occur from near the mine site to Big Timber. This increase in traffic would cause some additional road maintenance and safety hazards. Local and FS access roads would experience directly proportionally higher adverse effects related to present ADT levels. The amount of increased road traffic would depend on the size of the timber sale. Two projects, the Wright-Gulch Timber Sale and the Showdown Fuels Hazard Reduction, would increase traffic in the East Boulder River Valley for a short-term. However, the number of logging trucks associated with these activities would likely be a small percentage of the traffic using the roads for mine activities, and the overall impacts should therefore be minor.

## 4.11 LAND USE

### 4.11.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Impacts to land use are low, and include short-term indirect effects to the 28 full and part-time residents located along SG 31. Although about one-half of these are cabins or trailers used only a portion of the year, traffic from mine exploration causes increased noise and dust. The activity and facilities constructed under No Action result in a low to moderate impact to Forest Service Management Area (MA8) and call for some nonproductive timber management activities. However, this timber would be returned to MA8 if mine production did not take place.

### 4.11.2 Alternative 2 - Proposed Action

<u>Construction</u>. Some private land near SG 31 could be transformed from agricultural, ranch or residential-use to additional road right-of-way for widening and upgrading. Direct land use impacts, primarily timber production, would result from construction of the surface facilities. Less than four acres of timber production would be removed from the Brownlee Creek and Placer Basin permit areas. The Dry Fork grazing allotment would not be directly affected. The community of Big Timber would receive a population

increase which would require housing, and new residences or another trailer park would likely be constructed (See Section 4.14). Housing development could change some land use, likely from agricultural or ranching to residential. No commercial establishments are likely to be developed.

Operations. Similar impacts to residences along SG 31 would continue during operation as described for construction. Approximately 280 acres would remain out of timber production from Forest Service Management Area MA8. Nonproductive timber management activities would occur for the life of the project.

The proposed action would have an affect on land use patterns in Big Timber and possibly near the project area. Residential and some commercial development is likely to occur in Big Timber. Livingston may absorb similar effects on residential land use as described for Big Timber during construction. Private lands near the project site could incur residential development, although space is limited and there has been no indication of an intention by either SPGMR or the current owner to pursue this possibility. Additionally, an increase in residences located in the Main Boulder River Valley is likely. A more detailed discussion of housing development is found in Section 4.14.2.4, Socioeconomics.

Closure and Reclamation. The disturbed portions of the project area would be revegetated. Successful reclamation would restore much of the project area over time to its pre-mining uses of wildlife habitat, timber stock, and recreational opportunity. For the tailing impoundment area, timber harvesting would be restricted. Indirect impacts to residences along SG 31 would likely be reduced to approximately pre-mine development levels.

**4.11.3 Alternative 3 - Modified Tailing Impoundment Configuration**

The modified tailing impoundment configuration would cause similar impacts as described for the proposed action on tailing impoundment.

**4.11.4 Alternative 4 - Alternative Access Road/Power Line Alignments**

Bench Route (R2). Depending upon final location, the Bench Route (R2) could cause short-term moderate to high impacts to irrigated agricultural lands during road construction. Impacts could include higher than normal erosion due to construction practices, soil loss, and weed infestation. These impacts could continue for the life of the project if the final road alignment interferes with present methods of irrigating adjacent slopes. In addition, the road itself would remove an estimated 69 acres of agricultural lands from production. If the transmission line is constructed adjacent and parallel to the access road, pole construction would likely affect a small loss of productive (less than 0.1 acre per guyed structure, and less than 0.01 acre per unguyed structure) agricultural fields.

Bench/Valley Route (R4). The Bench/Valley Route (R4) could cause similar impacts for the bench portion as described for the Bench Route and similar effects described by the proposed action for the SG 31 portion of this alternative (Figure 2.4-2). Approximately 71 acres of agricultural lands would be removed from production for the duration of the mine project.

### 4.11.5 Alternative 5 - Power Supply Corridor Systems

Construction and operation of both power supply systems would likely impact irrigated agricultural lands, specifically those using mechanical distribution systems such as center pivot. Power distribution lines and poles could prevent efficient large-scale irrigation practices in some areas by inhibiting the mechanical rotation or progress of the water distribution system. Reclamation would return effects to the present condition.

### 4.11.6 Alternative 6 - Water Treatment Alternatives

Implementation of the water treatment alternatives would result in no additional impacts beyond those impacts described in Section 4.11.2.

### 4.11.7 Alternative 7 - Proposed Action with Modifications

No additional mitigation measures for land use have been proposed by DSL or GNF; therefore, the impacts under this alternative would be the same as those identified for Alternative 2 - Proposed Action (Section 4.11.2).

### 4.11.8 Alternative 8 - Twin Production Adits

Land use patterns resulting from implementation of Alternative 8 would not vary from those described in Alternative 7 with the exception that no mining related activity would occur in the Brownlee Creek permit area.

### 4.11.9 Cumulative Impacts

The cumulative effects on land use for other proposed projects and activities would be minor. The proposed Wright-Gulch timber sale would extract about 100 acres of timber. No additional agricultural lands are expected to be taken out of production as a result of reasonably foreseeable activities. An increase of truck traffic related to timber sales may cause a small increase in noise levels and frequency to residents adjacent to FAS 298.

## 4.12 VISUAL RESOURCES

### 4.12.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Impacts to visual resources are short-term and localized mostly to the foreground distance zone. Impacts from exploration activities and facilities in the partial retention visual quality objective (VQO) draw visual attention; however, they do not dominate the landscape. Visual contrast occurs primarily for vegetative landscape features adjacent to project facilities. Contrasts include modification of the landscape elements including form, texture, line, and color.

### 4.12.2 Alternative 2 - Proposed Action

Construction. Travel routes, recreation sites, and residences in the East Boulder River drainage are the critical observation points from which the visual resources of the area are viewed. Views of the three permit areas from these observation points are limited primarily to the foreground distance zone. Overall, the construction of facilities would create localized impacts to visual resources due to the removal of timber and other vegetation and their replacement with mine facilities. Impacts would be moderate to high in the foreground distance zone due to the change in landscape which would be defined by sharply contrasting elements of color, form, line, and texture between natural and mine-affected features.

Except for the tailing impoundment, the high visual absorption capability (VAC) features of topographic enclosure and vegetation height and density, particularly at the East Boulder permit area, would absorb most visual change in the foreground distance zone and would not allow facilities to be visible for any extended distances. Construction of the 140-foot-high tailing impoundment would create a dominant geometric landform drawing considerable visual attention and adversely affecting the visual resource. The tailing impoundment would be viewed primarily in the foreground distance zone, with some visibility of the feature extending out to the middleground and background visual distance zones. The objectives of the partial retention VQO would not be met, and the threshold of visual change would exceed those defined by the VQO.

Structures and facilities would create moderate to strong texture, form and line contrast. Color contrast would be less because facilities would be blended with the surrounding landscape colors. Reconstruction of SG 31 would cause short-term moderate line impacts east of the crossing of the Main Boulder River and low impacts further south to the GNF boundary. Moderate impacts would result along the Main Boulder River. Reconstruction and construction activities associated with the 69-kV transmission line would draw visual attention and create short-term moderate to high impacts particularly along FAS 298 and crossing of the Main Boulder River near SG 31. A total of 1.5 miles of transmission line located along access road SG 31 and FS 205 at the GNF boundary would continue to visually dominate the landscape.

Operations. Long-term impacts identified at the project site for construction would occur during the life of the project. Visual impacts of the project would generally be localized. The redesigned access road segments would cause small incremental increases of visual impact. The transmission line would cause a small additive low impact for rebuilt portions and moderate effects to the portion of new line up to the mine. For the transmission line, the introduction or modification of the vertical line landscape element would initially cause the visual change.

Construction of the 140-foot-high tailing impoundment would create a dominant geometric landform drawing considerable visual attention. However, the intrusion would be viewed primarily in the foreground distance zone, thus localizing its impact. Nevertheless, the impoundment would not meet visual quality objectives contained in the GNF Forest Plan.

Visual absorption for the transmission line would range from low near the McLeod substation to low to moderate along SG 31 to low to moderate to high from the GNF boundary to the project site.

Closure and Reclamation. After successful reclamation of the project site, the landscape would likely attain its previous classification of partial retention (PR) VQO. However, the tailing impoundment would attain the PR VQO over a considerably longer period of time because mature reforestation would be necessary

to co-dominate and soften the strong geometric lines and edges inherent in the design of the facility. It is possible the facility would never reattain the PR VQO level. The 69-kV transmission line would likely remain in place to service private land below the plant site. The portion of the access road to the project site road would likely remain. Visual impacts of the related facilities including redesigned access road segments and transmission line would remain as described for operation.

**4.12.3 Alternative 3 - Modified Tailing Impoundment Configuration**

The modification of a more gentle slope to the tailing impoundment configuration would cause a slight reduction in the line element of visual contrast to the landform, however high visual impacts would remain. The dominance of the landform would continue to draw visual attention and would exceed the objectives of the PR VQO.

**4.12.4 Alternative 4 - Alternative Access Road/Power Line Alignments**

<u>Bench Route (R2)</u>. The Bench Route (R2) would draw visual attention and cause short-term high visual contrast during construction to the PR VQO. During operations, long-term moderate visual contrast by the transmission line and low contrast by the access road would occur. The VAC is low to moderate for this alternative.

<u>Bench/Valley Route (R4)</u>. The Bench/Valley road (R4) would have impacts similar to those described for the Bench Route. These include high impacts to retention and partial retention VQOs during construction and low impacts to retention and partial retention VQOs during operation. Similar impacts as described for the proposed action would occur to the Valley segment including high and low-to-moderate impacts during construction and operation, respectively. The VAC for this alternative is low to moderate.

**4.12.5 Alternative 5 - Power Supply Corridor Systems**

Implementation of either power supply system would result in additional visual resources impacts which would draw visual attention from the Yellowstone River Valley and Interstate 90.

**4.12.6 Alternative 6 - Water Treatment Alternatives**

Implementation of a water treatment alternative would have no additional impact beyond those impacts described for Alternative 2 in Section 4.12.2 with the exception an additional structure or structures may be constructed and operated for the life of the treatment program thus adding to and possibly extending to the duration of localized visual impacts.

**4.12.7 Alternative 7 - Proposed Action with Modifications**

Impacts to visual resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.12.2) with the exceptions of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by DSL and GNF in this alternative would effectively reduce or eliminate residual visual resource impacts remaining after the application of the mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Tailing Impoundment Reclamation. Vegetation for reclamation of the tailing impoundment should be selected based on visual screening ability, as well as biological diversity and the criteria used by SPGMR in the proposed reclamation plan.

Visuals. Because development of the mine facilities would not meet GNF VQOs, a vegetation management program would be implemented where visual quality standards are exceeded. Locations where this program may be required include the area between FS 205 and the East Boulder campground; the millsite; and the tailing impoundment and plateau areas.

### 4.12.8 Alternative 8 - Twin Production Adits

Impacts to visual resources resulting from implementation of Alternative 8 would be similar to those described in Alternative 7. One important impact which would be eliminated under Alternative 8 is there would be no disturbance in the Brownlee Creek permit area, and therefore no degradation of visual quality.

### 4.12.9 Cumulative Impacts

Cumulative effects to visual resources brought about by other proposed projects and activities would be minor. The timber sales may cause visual disturbances which would not likely be visible from travel routes (other than FS 205), recreation areas, or residences. Other activities would be similar because of the physical landscape's inherent capabilities (topography, vegetation, density and height, and soil productivity) to absorb considerable amounts of visual modification.

## 4.13 RECREATION AND WILDERNESS

Assessment of impacts on recreational opportunity is difficult because of the complex factors contributing to wilderness use and recreational activities such as hunting and fishing. For instance, it is known that a large increase in the number of people traveling up the East Boulder River Valley would occur if the project is permitted. Also, mine development could create more and better access to trails and backcountry areas. While mine workers may be prone to use this area because of easy access, it may be that the numbers of traditional recreational users of the areas near the mine would decrease because of the mine presence and much larger human population. Opinions vary, even within the agencies directed to develop this EIS, as to the net effect of a project of the magnitude of the East Boulder Mine Project on the surrounding recreational opportunities. However, all agree that there would be displacement of recreational users and changes in the types, locations, and extent of recreational use. The best professional judgement of DSL and GNF as to the impacts upon recreation and wilderness is presented in the following section.

### 4.13.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Impacts to dispersed and developed recreation facilities in the vicinity of the approved Jackpine exploration project are likely to occur. Fishing demand on the East Boulder River will likely drop below the level of existing use. Local users will likely disperse themselves to other fishing areas. During the exploration activities, the quality of recreation experience (a semi-primitive setting) along the East Boulder River will be reduced near the project area as well as downstream. A portion of present users will be displaced to other fishing areas. After activities cease, the semi-primitive setting will likely return to near its present condition. Increased wildlife poaching is possible. The quality of hunting and associated

activities in East Boulder River Valley will be adversely affected particularly near the project area. Some increased use of Roadless Area 1-371 and the Absaroka-Beartooth Wilderness is likely to occur.

The East Boulder campground is located adjacent to FS 205, and increased traffic will cause indirect impacts of increased noise and dust for the campground. The dispersed campsite at the end of FS 205 road may be made unusable by the increase in traffic and improved road access.

**4.13.2 Alternative 2 - Proposed Action**

Construction. Direct impacts to hunting quality and dispersed recreation would result from project implementation. The East Boulder permit area is 260 acres. The fencing of this area and the mine operations would prevent big game species from using this area, and hunting would not be available on this land. The construction and operation of the mine would influence the distribution pattern of wildlife in the area, generally decreasing the number of big game species in the area surrounding the project site. There is one fall hunting outfitting permit in the vicinity of the project. The outfitter's camp is located at the headwaters of Dry Fork and may be directly affected by the project. The camp's quality of semi-primitive experience could be reduced and could cause the camp to be relocated. Access to the Dry Fork trail would require users to travel by the mine site. Day hunters would be affected insofar as they may have in the past hunted on or passed through the area disturbed by the mine project. An increase in poaching of big game and upland birds could occur. The designated permit area would not block access to any developed trails.

Fishing would still be available on the East Boulder River in the area adjacent to the East Boulder permit area. Access could be restricted in the two locations where the permit area actually crosses the river; however, most of the river would have a designated corridor buffer between the permit area and the river, which would allow access for fishermen. Although fishing activity could continue along this stretch of the river, the semi-primitive setting would be affected by the presence of the mine, creating an impact on the quality of the recreational experience. This would affect about 1.5 miles of river, including the confluence of the Dry Fork and the East Boulder River. The East Boulder River is classified as locally important (class 4 or gray ribbon), but not capable of supporting substantial fishing pressure on a regular basis. Accurate, up-to-date fishing pressure statistics are not available for the East Boulder River, although recreational use of the East Boulder River, in general, is considered to be low (Zubik 1990a). That assessment does not apply to the hunting resource, which receives a higher level of use.

The Brownlee Creek permit area is four acres. Disturbance at this site would result in minimal impacts to the recreation resource. The Placer Basin permit area is 580 acres. The area contains or would contain the Frog Pond vent raise and shaft site, and several other adits and vent raises spread out along the length of the permit area. Additional surface disturbance would be minimal; the site would be accessed primarily from the interior of the mine. When necessary, the permit area would be accessed via the Picket Pin Road (FS 140). The amount of traffic associated with both construction and operation is expected to be very low. The Graham Creek trail crosses the permit area in two locations. There is a summer outfitter who operates in this area. Guests are brought up the Graham Creek trail and make camp several miles south of the permit area. Trail access would not be limited through the permit area (Lawson 1990a) and impacts to the trail and users of the trail should be low. Except for the actual East Boulder mine site, the impacts to recreation are consistent with the objectives of the ROS classifications assigned to the study area.

The northeastern edge of Absaroka-Beartooth Wilderness would receive short-term indirect adverse effects infrequently, resulting from noise generated from construction activities. The opportunities for solitude in

this portion of the wilderness would be at times reduced particularly in the Placer Basin during construction. Similar types of impacts would occur to Roadless Area 1-371.

Operations. As shown on Table 4.14-3 of the Socioeconomics impacts assessment, an estimated total in-migrating population of 1,599 is anticipated. This includes both employed workers (mineral and secondary employment) and their dependents. Of this total in-migrating population, an estimated 957 would live in Big Timber, 239 would reside outside of Big Timber but in Sweet Grass County, and 403 would live outside of Sweet Grass County. This would result in approximately 60 percent increase in the population of Big Timber and approximately 40 percent increase in the population of Sweet Grass County as a whole.

A population increase of this magnitude would result in impacts to both dispersed and developed recreation resources. These impacts are estimated to be moderate to high in magnitude, based on the discussions provided below.

The campgrounds in the Main Boulder River drainage are presently underutilized. With the increased level of use of recreational facilities, these campgrounds would likely reach capacity more often. Scenic driving has been identified as one of the more popular activities in the Big Timber Ranger District. Traffic levels would increase on both the Main Boulder Road (FAS 298) and the access road to the mine site, SG 31 and FS205, from both worker traffic and recreationists. This would decrease the quality of the scenic driving experience, especially as few other roads are available which provide the aesthetic quality of this area. Hiking is also considered an important activity on the district, and an increase in use of trails would likely occur. With a higher level of use of recreational facilities and trails, there would be a slight increase of maintenance required for upkeep of these areas. The Absaroka-Beartooth Wilderness may receive indirect adverse effect periodically from noise generated by vent shaft fans or the machinery or mining traffic in the Placer Basin permit area (See Section 4.15).

Fishing and hunting are major local recreational activities. A 1982 survey done by Western Analysis showed that nearly 60 percent of local residents said they engaged in fishing, while 57 percent hunt. It is expected that the newcomers to the area would participate at least at the same level. In a survey of workers at the Stillwater Mine near Nye, Montana, 94 percent of the respondents said they fished (MDFWP 1988). A large portion of the Yellowstone and Main Boulder Rivers run through private land and access is limited. This would concentrate the increased numbers of fisherman on the readily accessible public fishing areas, creating a higher proportion of anglers per mile of fishing stream. The East Boulder River is not a major fishery and increased pressure may place a strain on the local fish population. Several private landowners have in the past allowed fisherman to fish on their lands. However, as more people ask permission to fish, this practice could be limited. Trespass on private land could increase.

Hunting is a very dispersed activity, and there is a substantial area of GNF lands available for hunters. However, in general, hunting pressure is usually the greatest in the vicinity of access roads and trails. These areas would receive the greatest impact from the increased number of hunters. The quality of the hunting experience and hunter success rate would decline if hunting pressure reaches the point where game is displaced. Although this may be unlikely considering the relatively low historical hunting use of the area (See Table 3.13-2), small increases in hunting pressure in localized areas can be very disruptive to wildlife patterns and habitat. With the improved access to the East Boulder Mine site and its convenience for mine workers, the East Boulder River drainage could initially have a higher increase in use by hunters, especially the Dry Fork and Placer Basin trail areas. There is also the possibility of an increase in violations of hunting regulations, including poaching. An increase in the sale of hunting and fishing licenses would add additional

monies to the MDFWP, partially offsetting some of the increase in costs associated with the increased use of these resources.

The winter recreation uses of the area includes some snowmobiling and cross-country skiing. There could be some increase in the number of people engaging in these activities, especially snowmobiling. Currently, recreationists use the unplowed portion of Forest Road 205 for both of these activities. If the proposed development takes place, Forest Road 205 would be kept open year round and would receive heavy traffic, displacing recreational use along the road. An increase in skiing and snowmobiling could occur from the end of the road to the Dry Fork and Placer Basin trails.

Recreational facilities and parklands in the community of Big Timber would likely receive substantially increased use proportional to the increase in total population, which is estimated at 60 percent. The Lions Club Park and ballfields currently receive a heavy use, and demand would likely exceed supply for these facilities. There are approximately ten retailers in Big Timber and Sweet Grass County that sell sporting or recreational goods - these businesses should experience an increase in sales. Presently, there is a 1 to 13.5 ratio of acres of recreation facilities per capita. To maintain this same ratio with the new incoming population, Big Timber would need to add 83 acres of similar recreation facilities.

<u>Closure and Reclamation</u>

During closure and project reclamation effects on dispersed recreation would return to slightly higher levels than at present. Use of developed recreation facilities would be reduced slightly, proportional to population decreases described in Section 4.14. The quality of recreation for the East Boulder River experience would return slowly over a long period of time.

### 4.13.3 Alternative 3 - Modified Tailing Impoundment Configuration

Similar effects described for the proposed action would occur for the tailing dam reconfiguration.

### 4.13.4 Alternative 4 - Alternative Access Road/Power Line Alignments

The Bench Route (R2) and the Bench/Valley Route (R4) access road and transmission line alternatives would not impact recreation resources because they do not cross lands used for recreation.

### 4.13.5 Alternative 5 - Power Supply Corridor Systems

Implementation of either power supply corridor system alternative would have no impacts on recreational resources because they do not cross lands used for recreation.

### 4.13.6 Alternative 6 - Water Treatment Alternatives

Implementation of any of the water treatment alternatives would have no additional impacts beyond those described for Alternative 2 in Section 4.13.2.

### 4.13.7 Alternative 7 - Proposed Action with Modifications

Impacts to recreation and wilderness resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Section 4.13.2) with the exception of those impacts mitigated by measures identified in Section 2.5. Additional mitigation measures required by DSL and GNF in this alternative would effectively reduce or eliminate residual recreational impacts remaining after the application of the mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Road Mitigations. Plowed roads in the national forest would be signed forbidding snowmobiling.

Recreation. SPGMR would provide suitable access to the Dry Fork and Lewis Gulch for public recreationists. A small parking area would be created near the mine for recreationists to leave vehicles in order to reach backcountry access locations. Also, mine construction, access roads, and transmission lines would be kept away from established hiking trails and other recreational facilities on forest service controlled lands to the maximum extent practicable.

### 4.13.8 Alternative 8 - Twin Production Adits

Implementation of Alternative 8 would add no additional environmental impacts to the recreational and wilderness experience of the East Boulder area than already described for Alternative 7. Alternative 8 would assure that no impacts arise at the Brownlee Creek permit area, although only minimal impacts are otherwise anticipated.

### 4.13.9 Cumulative Impacts

For recreational resources the cumulative effects would probably create both adverse and beneficial impacts. Proposed activities near the Absaroka-Beartooth wilderness would continue to generate noise and visual disturbance which encroach upon the solitude and pristine viewsheds of the wilderness. Perceived solitude and aesthetic quality of designated wilderness may be based on, among other things, the remoteness of the area and the knowledge of how far one is from development. The cumulative effects of large scale developments including existing and proposed mining ventures surrounding the Absaroka-Beartooth Wilderness may have an impact on this perception. As additional areas are developed adjacent to the Absaroka-Beartooth Wilderness the size of the area where the perceived aesthetic quality and solitude can be found may be reduced to its interior.

Opportunities would be created for dispersed recreation activities resulting from access roads constructed for timber sales. Increased road access would provide additional opportunities for hunting, firewood gathering, semi-primitive camping, and driving for pleasure. Wildlife poaching and illegal ORV use would likely occur as a result of other proposed projects and activities.

## 4.14 SOCIOECONOMICS

This section identifies potential socioeconomic impacts associated with the proposed action and alternatives. Socioeconomic elements addressed in this section include economic conditions (employment and earnings), population, housing, local government facilities and services, schools, local government fiscal conditions, and attitudes, opinions and lifestyles.

An impact assessment must consider the context in which the proposed action and alternatives would occur. Section 3.14 provided an inventory of existing socioeconomic conditions in Sweet Grass County, the area which would be affected by the proposed action and alternatives associated with the East Boulder Mine Project.

In addition to the economic, population, housing and local government context described in Section 3.14, the East Boulder Mine Project would occur in a regulatory and institutional context mandated by the Montana Hard-Rock Mining Impact Act and the Montana Property Tax Base Sharing Act, as amended.

The purpose of these two acts is (a) to enable local government units to provide services and facilities when and where they are needed as a result of new large-scale, hard-rock mineral developments; (b) to ensure that the local taxpayer will not have to bear the increased local government costs resulting from the development; and (c) to help meet ongoing increased costs from the development in local government units where the mine is not located. In addition, the statutes governing the assessment and disposition of funds of the metal mines license tax provide for the creation of reserves at the county and local school district level to lessen the negative effect on the local economy and local tax base of a mine workforce reduction or mine closure (Montana Hard-Rock Mining Impact Board 1988).

Among the impact mitigation mechanisms available under Montana statutes, four are appropriate for the proposed East Boulder Mine Project. These are:

- The preparation of an impact plan, which becomes a condition of the operating permit of each new large-scale, hard-rock mine. In the plan, the developer identifies and commits to pay to affected local government units all increased capital and net operating costs resulting from the new mine. Payment may be by means of property tax prepayments, grants, or impact bonds. The developer may also provide non-financial assistance which will reduce or forestall increased local government costs.

- The allocation among affected local government units of the increase in taxable valuation of the mineral development which occurs after the mine operating permit is issued.

- A trust account grant-loan program to mitigate local government and community economic impacts resulting from a 50 percent reduction in workforce or the closure of a mine that has paid metal mines license taxes since 1985 (Montana Hard-Rock Mining Impact Board, 1988).

- Metal mines tax allocations to counties and local school districts.

At the time of this analysis, SPGMR is developing an impact plan in consultation with Sweet Grass County, the City of Big Timber, and the affected school districts under the provisions of the Montana Hard-Rock Mining Impact Act. While this plan has not been completed, the successful implementation of the elements of the plan under consideration (particularly those elements designed to direct growth to Big Timber) would result in avoidance and mitigation of many potential socioeconomic impacts associated with the East Boulder Mine Project. (See Section 1.4 for a general discussion of the Hard-Rock impact plan).

Because impact planning for the East Boulder Mine Project is under way, certain objectives and elements of the plan already are known. As part of the institutional environment in which the proposed action would

take place, these elements of the plan are recognized by this assessment and are taken into account in projecting the size and distribution of impacts among affected areas and units of local government.

At the same time, it is important to note that the components of the socioeconomic analysis presented here (in terms of data collection, methods, and assumptions) were developed independent of the ongoing impact planning process. Consequently, they provide an objective, independent analysis of the projected impacts of the proposed action.

Although the analysis presented here accepts a presumption by SPGMR and the State of Montana that the statutory impact planning process can minimize negative impacts and accentuate positive impacts of the East Boulder Mine Project, the potential exists for impacts to occur which are considerably different from those projected here. Such differences would occur if there is a breakdown in the execution of the impact plan. This potential exists precisely because impact management is a part of the existing environment and will play an active role in events in the future.

The analysis presented here assumes that growth associated with the proposed action would be concentrated in Big Timber because appropriate mechanisms and capabilities (provided by the impact plan) would be in place, allowing Big Timber to expand and accommodate growth. However, an impact projection which depends on successful execution of the impact plan is vulnerable to breakdown in several areas.

- First, projected population impacts depend on SPGMR's hiring and personnel development policies. If intended local hiring targets are not met, the proposed action would generate higher than projected numbers of in-migrants.

- Second, even assuming intended levels of local hiring, the projected growth is so large relative to the size of the existing community that it would be a challenge to find adequate lead time to develop the infrastructure and housing needed to serve the dominant growth share Big Timber is intended to accommodate. If Big Timber is unable to accommodate the projected level of growth, growth would spread to other areas of Sweet Grass County, leading to a different set of impacts entirely.

- Third, impact is managed with more than just capital and operating expenditures; it also requires active management, planning, personnel, and expertise. The capability must be in place to coordinate a complex community development strategy for Big Timber and Sweet Grass County and to respond to a dynamic unfolding of events which may present unanticipated problems.

- Finally, maintaining the social well-being of the community depends on managing impacts well. Should rapid growth in Big Timber appear out of control, stresses felt by newcomers and existing residents alike may be reflected in a variety of ways including higher than projected human service caseloads, higher than expected levels of dissatisfaction with the quality of life, and a deterioration in the community's social fabric.

These potentialities make it clear that the successful implementation of the impact plan being developed now is necessary to the realization of the impacts anticipated in this analysis.

Minimal Impacts in Livingston and Columbus

A note is appropriate regarding impacts of the proposed action on the cities of Livingston and Columbus. It is expected that a portion (assumed to be 20 percent for this analysis) of the in-migrating workers associated with the East Boulder Mine Project would move to Livingston and Columbus and commute to the mine in Sweet Grass County on a daily basis. Under the assumptions used in this analysis, population growth attributable to in-migrant project workers and their families residing in Livingston and Columbus would be approximately five percent over current levels, spread over the 5-year period of mine development and first year of operations. Thus, the socioeconomic effects of additional population projected for Livingston and Columbus would be expected to be minimal and no further consideration is given to these effects.

**4.14.1 Alternative 1 - No Action**

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. The socioeconomic effects of this 24- to 27-month long mineral exploration project are described in the Jackpine Exploration Project EA (1988). In summary, they include a work force that increases from a total of 19 workers in the first quarter to a peak of 157 in the eighth quarter, decreasing to 65 by the final quarter of the project. Of these, an estimated 33 percent will be hired locally and 67 percent will be non-local or newcomers to the community. The total population associated with the non-local workers is estimated to be 216 people during the peak quarter.

The housing demand associated with the non-local workforce will be accommodated by housing resources in Big Timber primarily, and, to a lesser extent, in Livingston and the Main Boulder River Valley. The scarcity in existing housing resources in Big Timber and the Main Boulder River Valley and the distance to Livingston may result in either temporary housing or mobile home park construction along the Main Boulder River, according to the EA.

Traffic on the Main and East Boulder Roads will be greatly increased as a result of the Jackpine Exploration Project. Water, sewer, and fire protection services should not be affected by the project. The EA states that existing solid waste disposal resources might not be able to handle the volume of waste generated by the project; however, the county has recently developed a new landfill which would be adequate to handle the increase in volume. Law enforcement and welfare caseloads are expected to increase as a result of the Jackpine Exploration Project. Hospital and health care facilities are anticipated to be adequate to accommodate the additional demand.

The project is anticipated to result in an estimated peak of 27 to 32 new elementary students which could be accommodated in existing Big Timber Elementary School District facilities. The estimated peak of 12 new high school students associated with the project could be accommodated in existing Big Timber High School District facilities. The McLeod Elementary School District is not likely to experience substantial increases in enrollment as a result of the project, under assumptions used in the analysis contained in the EA.

Under the No Action Alternative, the project development activities described under the proposed action and other alternatives will not occur. The economic, population, housing, and public facility, service, and fiscal effects described under the proposed action alternative would not occur, nor would the effects of the project on community attitudes, opinions, and lifestyles. Economic and population conditions in Sweet Grass

County would be anticipated to remain fairly stable for the foreseeable future. Demand for housing, public facilities, and services would remain fairly constant at existing levels. Local government fiscal conditions could be expected to follow statewide (and to a certain extent) national trends of declining revenues and increasing costs which could potentially result in a decline in the level of services.

### 4.14.2 Alternative 2 - Proposed Action

#### 4.14.2.1 Project-Related Employment

Factors affecting the timing and magnitude of socioeconomic impacts are project hiring schedule, the existence of a locally available workforce, and the need for additional workers and their families to in-migrate to the area. SPGMR has prepared employment estimates for the mine development period.

Direct Project Employment

The construction phase would cover Year 1. Operations employment also would begin in the first quarter of Year 1 and would increase gradually through the fourth quarter of Year 5. Total employment would reach a plateau in Year 6 which would be maintained for the remaining years of the project. Table 4.14-1 presents quarterly construction and operations employment levels for Year 1. Table 4.14-2 presents annual average construction and operations employment levels for Year 1 through Year 6.

Direct construction employment would peak in the second quarter of Year 1 at 102 construction workers. Although construction employment would decline to about 70 percent of peak by the end of the year, total employment would reach a temporary peak in the fourth quarter of Year 1 at 330 workers because of increasing operations employment. Operations employment would continue to rise throughout the rest of the development period. In terms of average annual employment, the workforce would reach about 60 percent of maximum in Year 2, 70 percent in Year 3, 80 percent in Year 4, and 95 percent in Year 5.

TABLE 4.14-1

EAST BOULDER PROJECT: QUARTERLY CONSTRUCTION AND OPERATIONS IN YEAR 1

| | Year 1 | | | | |
|---|---|---|---|---|---|
| Employment by Phase | 1st Qtr | 2nd Qtr | 3rd Qtr | 4th Qtr | Avg |
| Construction | 87 | 102 | 82 | 72 | 86 |
| Operations | 98 | 126 | 196 | 258 | 169 |
| Total | 185 | 228 | 278 | 330 | 255 |

Source: SPGMR 1990

TABLE 4.14-2

EAST BOULDER PROJECT: ANNUAL AVERAGE CONSTRUCTION AND OPERATIONS EMPLOYMENT

| Employment by Phase | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Years 6-20 |
|---|---|---|---|---|---|---|
| Construction | 86 | 0 | 0 | 0 | 0 | 0 |
| Operations | 169 | 350 | 428 | 507 | 570 | 603 |
| Total | 255 | 350 | 428 | 507 | 570 | 603 |

Source: SPGMR 1990

The existence of an available workforce would determine the need for additional workers (and dependents) to in-migrate to the area. Assumptions on local area hiring were developed by examining a detailed breakdown of East Boulder Mine Project employment levels by job category. Each category was assessed as to whether workers with the requisite job skills would be available locally. Data from local job service records and information from locally knowledgeable sources were taken into account. It was assumed that as the project develops, workers living in the area would receive training, making them more qualified for mine employment. Also, graduating high school seniors would add to the locally available workforce. Consideration also was given to information on workforce availability in Livingston and Columbus. Available workers living in these two locations were assumed to commute on a daily basis rather than move closer to the project.

The results of the analysis led to the assumption that approximately 45 percent of construction jobs would be taken by local or area hires. Local and area hiring for operations workers would vary as the project develops, given worker training and current high school students maturing and joining the workforce. The share of local hires in the operations workforce is assumed to be about 10 percent in Year 1, 7 percent in Year 2, 10 percent in Year 3, 23 percent in Year 4, 31 percent in Year 5, and 34 percent in Year 6 through the end of the project.

These local hiring estimates are dependent on SPGMR local hiring policies and training programs. If these policies and programs are not successful, there would be a corresponding increase in in-migrating workers which would, in turn, create greater demands for housing and community services than are projected in this analysis.

Job Shift

One employment effect which may occur in the affected area is job shifting. Since the proposed action would offer wage levels which are higher than the average for currently existing employment opportunities, many local residents who are employed now may seek employment at the proposed mine and would perhaps change jobs. Job shifting would affect the total population impact of the proposed action.

It is unlikely that much job shifting would occur during the first year or two of development because the jobs created at the mine would be specialized and require skills unavailable locally. However, in later years local hiring by the mine likely would include currently employed workers. These workers would be replaced in their previous jobs and a sequence of job changes would occur.

Constraints in the housing and labor markets in Big Timber and Sweet Grass County would shape the effect of job shifting. If housing in the area proves to be difficult to obtain, as may occur if the housing supply is not increased sufficiently through impact planning and management, more jobs vacated by workers shifting to mine employment would tend to be taken by employees drawn from the households of existing workers and workers immigrating to take newly created jobs at the mine or elsewhere. Job shifting under tight housing and labor conditions also may generate more in-commuting from places nearby, such as Livingston or Columbus.

Having more than the assumed number of jobs taken by persons already living in Big Timber or Sweet Grass County or by persons who commute rather than move would tend to reduce the population impacts of the proposed action below the levels projected in this analysis.

Indirect Employment

Growth in basic industry usually creates indirect employment opportunities, primarily in the service and retail trade sectors (e.g., restaurants, retail stores, etc.). In Sweet Grass County, indirect employment opportunities also would be created in construction as new housing and community service facilities are constructed (referred to here as secondary indirect construction employment) and in local government employment as new city and county employees and new teachers are hired.

In Sweet Grass County, it is estimated that each new direct project construction job taken by a local resident or an in-migrant worker would lead to 0.2 new indirect employment opportunities and each new mining job would lead to 0.4 new indirect employment opportunities. Using the figures supplied in Tables 4.14-1 and 4.14-2, indirect employment opportunities would increase from 85 during year 1 to a peak of 241 indirectly created jobs during years 6 through 20 of mine operation.

A multiplier of 0.4 indirect jobs per mining job has been used based on experience with similar projects and on discussions with SPGMR and Montana Job Service officials. The relatively low multiplier reflects the fact that infrastructure and a network of vendors to supply the East Boulder Mine Project already are in place due to the prior existence of the Stillwater Mining Company mine at Nye, Montana. It is assumed that the infrastructure and vendor network would not be recreated. In addition, Big Timber and Sweet Grass County already have a service economy which serves seasonal tourism and recreation visitors. Because of its seasonality, the service economy has capacity available to service growth related to the East Boulder Mine Project without additional expansion. Finally, it is expected that there would be leakage of demand from Big Timber and Sweet Grass County. The community is located on the interstate highway, and there is an established tradition of local residents going to Livingston and Billings for goods and services. It is assumed that pattern of leakage would continue. It should be noted that the multiplier of 0.4 includes what, in input-output terms, would be both the indirect and induced effects of direct mine employment. Of the indirect employment opportunities created during Years 1 and 2, 50 percent would be in secondary construction and the remainder would be in other employment sectors. In Year 3, 25 percent of indirect employment opportunities would be in secondary construction. In Year 4 and beyond, all indirect employment opportunities would be in other employment sectors.

Residents of the towns of Livingston and Columbus would take some of the jobs at the East Boulder Mine Project. These jobs also would generate indirect employment opportunities. In Columbus, indirect employment opportunities would be generated at the same rate as in Big Timber. In Livingston, indirect employment opportunities would be generated at a somewhat higher rate because less income would leak out of the local economy. The assumed rates for Livingston are 0.3 indirect employment opportunities per construction job and 0.5 indirect employment opportunities per operations job for East Boulder Mine Project jobs taken by Livingston residents.

About 50 percent of the indirect construction workforce are assumed to be hired locally, and about 80 percent of other indirect workers are assumed to be hired locally.

#### 4.14.2.2 Impact Population and School-Age Children

Baseline (without the proposed action) population in Sweet Grass County and the City of Big Timber is expected to remain relatively stable over the next ten years, with little incremental growth. The impact of growth in population and numbers of children in school associated with the proposed action is determined by how many employees in-migrate to take direct and indirect jobs, where in-migrating employees choose to settle, and the size and composition of families accompanying in-migrant workers in terms of school-age children and others in the household.

It is assumed that workers would in-migrate to take all direct jobs not taken by local or area residents. Because of the nature of many indirect jobs, it is assumed that for every ten indirect jobs created and not taken by local residents, only six new employees would in-migrate. This is based largely on the assumption that workers already in-migrating to take other direct or indirect jobs would bring with them a number of other household members able and willing to compete for newly created indirect jobs.

All things being equal, it is assumed that in-migrating workers would live as close to the job as possible. In practice, a number of factors affect where in-migrating workers settle: housing availability and costs, availability and quality of community facilities and services (including schools), and quality of transportation alternatives, whether the workers hold direct or indirect jobs, and whether workers are involved in construction, operations, or other activities.

The following factors were considered in assessing the percentage of in-migrating direct workers that would be attracted to Big Timber: the city's proximity to the proposed action, the existing facilities and services, the fact that housing is neither available or easily developed in unincorporated portions of the county, and, an important consideration, the fact that Big Timber is actively attempting to create additional residentially zoned land and to serve that land with infrastructure. Given these factors, it is assumed that the City of Big Timber would attract 60 percent of all in-migrating direct operations workers. For the same reasons, it is assumed that the rest of Sweet Grass County would attract 15 percent of all in-migrating direct operations workers. The rest of Sweet Grass County would include the Main Boulder River Valley, which is close to the project but has limited current and prospective housing availability.

In-migrating direct construction workers would follow a different pattern of residential location. Because temporary housing would be available only in the City of Big Timber, it is assumed that the City of Big Timber would attract 72 percent of in-migrating direct construction workers, while the rest of Sweet Grass County would attract 3 percent.

Twenty-five percent of the in-migrating direct workforce (both construction and operations) would live outside Sweet Grass County, with 80 percent of those (20 percent of all in-migrants) locating in Livingston which offers more housing, facilities, and services, and which, despite its distance, is linked to Big Timber by I-90, an excellent transportation route. Five percent of all in-migrating direct workers are assumed to locate in Columbus which also is on I-90.

Employees in-migrating to take indirect, non-construction jobs are assumed to distribute themselves in the same proportions as in-migrating direct operations workers. In-migrating indirect construction workers are assumed to distribute themselves in the same proportions as direct construction workers.

Assumptions about the demographic characteristics of in-migrating workers depend on their jobs. Workers in-migrating to take direct jobs at the East Boulder Mine Project are assumed to have characteristics reflected in the workforce monitored at the Stillwater Mining Company project at Nye, Montana. Based on the experience at Nye, each direct operations worker would bring an additional 2.83 persons, including 0.58 children in grades K through 8 and 0.28 children in grades 9 through 12. Each in-migrating construction worker would bring an additional 2.39 persons, including 0.35 children in grades K through 8 and 0.04 children in grades 9-12. Construction worker characteristics are based on Nye monitoring data derived from the construction phase of that project.

Demographic characteristics for in-migrating indirect workers are based on Montana averages. Each in-migrating indirect worker is assumed to bring an additional 1.58 persons, including 0.35 children in grades K through 8 and 0.14 children in grades 9 through 12.

As a result of these assumptions, the expected settlement patterns of the in-migrating population is presented in Table 4.14-3. Peak in-migration in Big Timber would be 957 total people in Year 6. Peak in-migration to the rest of Sweet Grass County would be 239 total people. Livingston and Columbus combined would receive 403 people.

Settlement patterns are to a large extent dependent on the availability of housing and residentially zoned land. If Big Timber is unsuccessful in its attempts to create additional residentially zoned land or if housing is not developed (either privately or by SPGMR) in time to meet demand, than the settlement patterns could differ substantially from those projected for this analysis.

It is also important to note that settlement patterns assumed for this analysis are predicated on the provisions of the Sweet Grass County Growth Policy Plan that discourage relatively dense residential development in unincorporated portions of the county, particularly in the Main Boulder River Valley. If the county allows such subdivision to occur, settlement patterns could differ from those contained in this analysis.

#### 4.14.2.3 Income Effects

Average earnings per worker at the East Boulder Mine Project would be $35,000 per year. The resulting payroll is presented in Table 4.14-4. The project would generate about $21,105,000 in total direct annual earnings in Year 6 and thereafter for the life of the project. Based on the assumptions about the residential location decisions of direct project workers, approximately 75 percent of direct earnings (or $15,828,750 per year) would go to residents of Sweet Grass County in Year 6 and thereafter.

The earnings of direct workers which would be spent within the project area would generate the indirect employment discussed above. The indirect employment associated with the East Boulder Mine Project would lead to additional income in the project area. Assuming an average annual income of $15,710 for indirect workers involved in construction during Years 1-3, $13,120 for other indirect workers in Years 1-3, and $13,440 for indirect workers in Years 4-6 and beyond, indirect employment associated with the project would be expected to generate about $3,400,000 in total indirect annual earnings in Year 6 and thereafter (Table 4.14-5). Based on the assumptions about the residential location decisions of indirect workers generated by the project, approximately 75 percent of indirect earnings (or $2,550,550 per year) would go to residents of Sweet Grass County in Year 6 and beyond.

In addition to earnings associated with direct and indirect employment, the East Boulder Mine Project would make substantial purchases of supplies and services. It is not known how much money the project would spend on purchases or how much of this money would be spent within the project area. However, total expenditures on similar projects are substantial and capture of a small share could generate considerable local business income.

#### 4.14.2.4 Housing

Housing demand in Sweet Grass County, in terms of the total number of housing units needed to serve immigrant workers and their families, would rise quickly during the first three years of the project development period and would reach its highest level in Year 6 of the project. The housing units needed would fall into two general categories: (1) temporary housing, consisting of recreational vehicle (RV) spaces and motel rooms, and (2) family housing, consisting of apartments, homes or mobile homes for sale or rent.

Because mining construction projects often are undertaken by specialized contractors who are on site for limited periods of time, a proportion of the construction workforce would require temporary housing. Other construction employees whose jobs are administrative or supervisory in nature, and may be in the area for the duration of the construction phase, as well as operations employees who are being hired during the construction phase of mine development, are likely to be accompanied by a spouse, children and other household members and would prefer family housing.

The housing demand projections are based on several assumptions. First, it is assumed that 80 percent of the direct project construction workforce on site during the first-year construction phase and of the indirect workforce involved in major housing and infrastructure construction in Big Timber and Sweet Grass County during the first three years of the mine development period would prefer temporary housing units. The remainder of workers in these categories would prefer family housing. Since temporary housing would not be available in the rest of Sweet Grass County, all workers in these categories seeking temporary housing would be assumed to locate in Big Timber.

Second, it is assumed that all direct operations employees of the East Boulder Mine Project and other indirect in-migrant workers would choose family housing. Finally, it is assumed that among workers preferring temporary housing, an average of 1.2 workers would share a single housing unit. For other workers, it is assumed each in-migrant employee would create a demand for a single housing unit.

TABLE 4.14-3
EAST BOULDER PROJECT: IN-MIGRANT POPULATION AND SCHOOL-AGE CHILDREN, BY LOCATION

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| Big Timber | | | | | | |
| In-migrant Workers | 144 | 225 | 253 | 249 | 254 | 256 |
| Children K-8 | 71 | 123 | 140 | 140 | 142 | 143 |
| Children 9-12 | 29 | 58 | 67 | 67 | 68 | 69 |
| Others in Household | 269 | 417 | 479 | 479 | 487 | 490 |
| Total | 513 | 823 | 939 | 934 | 952 | 957 |
| Other Sweet Grass County Areas | | | | | | |
| In-migrant Workers | 26 | 51 | 60 | 62 | 63 | 64 |
| Children K-8 | 14 | 29 | 34 | 35 | 36 | 36 |
| Children 9-12 | 7 | 14 | 16 | 17 | 17 | 17 |
| Others in Household | 50 | 99 | 116 | 120 | 122 | 122 |
| Total | 96 | 192 | 226 | 234 | 238 | 239 |
| Total Sweet Grass County | | | | | | |
| In-migrant Workers | 170 | 276 | 313 | 311 | 317 | 319 |
| Children K-8 | 85 | 151 | 174 | 175 | 178 | 179 |
| Children 9-12 | 36 | 72 | 83 | 84 | 85 | 86 |
| Others in Household | 318 | 516 | 595 | 598 | 609 | 612 |
| Total | 610 | 1015 | 1166 | 1168 | 1190 | 1196 |
| Other Locations (Livingston and Columbus) | | | | | | |
| In-migrant Workers | 58 | 94 | 106 | 105 | 107 | 108 |
| Children K-8 | 29 | 51 | 59 | 59 | 60 | 60 |
| Children 9-12 | 12 | 25 | 28 | 29 | 29 | 29 |
| Others in Household | 108 | 174 | 201 | 201 | 205 | 206 |
| Total | 208 | 344 | 394 | 393 | 400 | 403 |

Note: Numbers may not add to totals due to rounding.

TABLE 4.14-4

EAST BOULDER PROJECT: ESTIMATED ANNUAL PAYROLL FOR DIRECT PROJECT EMPLOYMENT

| | Annual Average Employment: Direct Construction and Operations | Amount (1990 $000s) |
|---|---|---|
| Year 1 | 255 | $8,925 |
| Year 2 | 350 | 12,250 |
| Year 3 | 428 | 14,980 |
| Year 4 | 507 | 17,745 |
| Year 5 | 570 | 19,950 |
| Year 6-20 | 603 | 21,105 |

TABLE 4.14-5

EAST BOULDER PROJECT: ESTIMATED TOTAL ANNUAL EARNINGS FOR INDIRECT EMPLOYMENT GENERATED BY THE PROJECT

| | Annual Average Employment: Indirect Construction and Other | Amount (1990 $000s) |
|---|---|---|
| Year 1 | 90 | $1,297 |
| Year 2 | 146 | 2,105 |
| Year 3 | 180 | 2,478 |
| Year 4 | 213 | 2,863 |
| Year 5 | 239 | 3,212 |
| Year 6-20 | 253 | 3,400 |

Based on these assumptions about housing accommodations choices, Table 4.14-6 presents the number of housing units by type which would be needed by direct and indirect in-migrant workers to Big Timber and the rest of Sweet Grass County. Because of the limited duration of construction activity, temporary housing units would be needed during Years 1-3 of the mine development period. These years cover direct mine construction and the anticipated construction of housing, schools, and infrastructure in Big Timber.

Temporary housing demand for Year 1, as presented in the table, reflects the average level of demand for the year. Because of the peak in the direct construction workforce projected by SPGMR to occur in the second quarter of Year 1, demand for temporary housing also would peak at a level approximately 19

percent higher than average (or an additional six temporary housing units) for about three months of Year 1. Also, total housing demand in Big Timber would reach a slight interim peak in Year 3 because of the expected continued secondary construction activity and the preference of construction workers for temporary housing expected to be available only in the city.

The assumptions upon which the housing needs projections are based have considered the number and job status of in-migrating direct and indirect workers, the family characteristics of in-migrating workers taking the available jobs, size and distance from the proposed mine of communities surrounding the project site, and currently known elements of SPGMR's preliminary impact plan. These factors interact with housing availability and the potential for housing development when projecting a likely pattern of residential location for immigrating workers and families.

Housing availability and the potential for new housing is based on the existing conditions in various areas:

- Existing housing is a limited commodity in Sweet Grass County and the City of Big Timber. New construction activity also has been limited in recent years.

- There are 233 vacant building lots in Big Timber, but some of these lots are in areas that contain mixed uses or older, smaller homes and are not expected to attract new residential development. Approximately 94 are likely to be developed. The lots are small and probably would require one-and-a-half lots per new housing unit. There is also a recently approved 5-lot subdivision in the southeast quadrant of the town.

- Big Timber is developing annexation and facilities plans for several parcels outside city limits which have been zoned residential; this extraterritorial zoning is interim zoning which would expire at the end of calendar 1993 if the parcels are not developed.

- There is a potential for residential development in the Main Boulder River Valley. However, development in the Main Boulder River Valley is subject to a number of uncertainties. In the lower Main Boulder River Valley, the existing Sweet Grass County Growth Policy Plan discourages subdivision. Additionally, there is an initiative by some lower Valley residents to develop more stringent land use controls. In the upper Main Boulder River Valley, the existing growth policy plan discourages major subdivision and suggests density limits.

- If subdivided, the Main Boulder River Valley would be attractive to in-migrating mine workers because it would be close to the project site. However, any subdivided land in the valley is likely to be expensive and lead to housing development costs which would discourage residential location by most East Boulder Mine Project employees.

- One existing subdivision in the Main Boulder River Valley has 12 parcels for sale.

TABLE 4.14-6

EAST BOULDER PROJECT: IN-MIGRANT WORKER HOUSING NEEDS
IN BIG TIMBER AND SWEET GRASS COUNTY

| Housing Units | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
|---|---|---|---|---|---|---|
| | | | Big Timber | | | |
| Temporary | 32 | 17 | 10 | 0 | 0 | 0 |
| Family | 105 | 205 | 241 | 249 | 254 | 256 |
| Total | 137 | 221 | 251 | 249 | 254 | 256 |
| | | | Other Sweet Grass County Areas | | | |
| Temporary | 0 | 0 | 0 | 0 | 0 | 0 |
| Family | 26 | 51 | 60 | 62 | 63 | 64 |
| Total | 26 | 51 | 60 | 62 | 63 | 64 |
| | | | Total Sweet Grass County | | | |
| Temporary | 32 | 17 | 10 | 0 | 0 | 0 |
| Family | 131 | 256 | 301 | 311 | 317 | 319 |
| Total | 163 | 272 | 311 | 311 | 317 | 319 |

Note: Numbers may not add to totals due to rounding.

Housing For Persons With Fixed Income

As the housing market in Big Timber and Sweet Grass County reacts to the population impacts of the proposed action, the potential exists for impacts on fixed-income individuals and families. The existing housing market is tight, with a limited number of available housing units and a lower vacancy rate than would be needed for the housing market to respond efficiently to the expected intense demand for housing during the first two or three years of mine development. The combination of tight supply and high demand would be expected to raise the price of existing and new housing. An increase in the cost of housing would have a potential adverse effect on elderly persons and other persons on fixed incomes, particularly those who currently are living in rental housing units. Related impacts may include the potential for higher costs of home repair and upkeep.

#### 4.14.2.5 Community Facilities and Services

This section presents the projected impacts on community facilities and services which have been determined based on the assumptions used in this analysis. The assumptions most critical to the projection of community facility and service impacts include the following:

- Housing and public facilities (sewer and water main and capacity) will be in place in time to accommodate project-related population growth.

- Local hiring policies which target and train local workers will be implemented. The percentage of the operations work force hired locally will total 7 to 10 percent during the first 3 years of the project, increasing to 34 percent during full operations.

- Sweet Grass County growth policies that encourage growth in Big Timber and discourage high density development in the Main Boulder River Valley will be enforced.

If the above assumptions are accurate, the community facility and services impacts contained in this analysis should also be reasonably accurate. If these assumptions are inaccurate, the population associated with the East Boulder Mine Project and the distribution of that population could be substantially different than the projections contained in this analysis, resulting in substantially different impacts on community facilities and services.

Impacts are identified in terms of services for which existing capacity, personnel or facilities may be inadequate and/or for which existing personnel and facilities may need to provide a higher level of service. For each community facility or service, impacts are projected based on the demand associated with the East Boulder Mine Project population projections contained in Section 4.14.2.2. A discussion of impacts associated with the special characteristics of the population or project is also provided where appropriate. This approach assumes that local government employees are operating at or near capacity (a reasonable assumption given recent federal and state cutbacks in funding for communities). The approach also assumes that the project related population will generate demand for public facilities and services at rates similar to existing residents. While this approach is likely to be valid in most cases, it may not be valid during the early, rapid growth years of project development. Therefore, the analysis provides a discussion of specific instances where project-related public services demand rates may be higher than existing demand rates.

Impacts on Sweet Grass County government are presented first, then impacts on the Big Timber city government. Next, impacts are presented which affect other public safety, health, welfare and human services available in Sweet Grass County; these services are provided by a variety of jurisdictions. Finally, impacts on public schools are presented.

Sweet Grass County

Impacts of the East Boulder Mine Project on facilities and services operated by Sweet Grass County are based on a total projected population impact in Year 6 of 1,196 persons and 319 households; 80 percent of the impact in Sweet Grass County would occur in Big Timber. Under the proposed action, Sweet Grass County population would increase about one-third over 1990 levels during the first two years of the project and by almost 40 percent at full operations.

**General Government Management and Administration.** Currently Sweet Grass County is managed by three part-time county commissioners with assistance from the county clerk and recorder and other department heads. There were a total of 20 general government employees during 1990.

Under the proposed action, Sweet Grass County government would be required to provide services to the additional population, but then would be required to recruit, hire, and train additional staff, and improve and update management systems that are designed for stable population conditions and may not function well under rapid growth conditions.

For example, the county currently has no computerized administrative operations; the relatively large, rapid population increase similarly would strain many of the manually operated record keeping systems. Land use issues would increase substantially, generating demand for additional current and long-range planning activities. The change from stable conditions to a rapid growth environment may create demands on management systems that may exceed the existing county management capacity.

The projected increase in the county's population would result in demand for six to eight additional general government staff, including a county administrator or administrative assistant to assume the additional management duties that would be required during the early rapid growth years.

**Sheriff.** Projected 30 to 40 percent increases in population are likely to generate at least 30 to 40 percent more calls for service for the Sweet Grass County Sheriff's Office. During the early rapid growth period of the project, calls for service could exceed this proportional increase. Most of the new need for service would be in Big Timber where 80 percent of the impact population is projected to reside.

To accommodate this increased demand, the Sweet Grass County Sheriff would require at least two additional deputies. Hiring an additional deputy entails added annual operating costs for salary, benefits, and support; it also requires capital outlay for a deputy's car and ongoing vehicle operating and maintenance costs.

As population and calls for service increase, use of the county's single jail cell would increase, as well. Currently, detainees who cannot be housed in the jail must be taken to detention centers elsewhere at a cost in transportation, per diem, and lost time for the transporting deputy. By court order, the single-room jail can be used only as a three-day holding cell, and its location in the courthouse poses a security risk. A 30 to 40 percent increase in use would focus attention on a facility already judged sub-standard for current needs and being considered for upgrading. It is also likely that deputies would no longer have time to perform jailer functions necessitating the hiring of part-time jailers.

Big Timber would contain a larger share (57 percent in year 6 compared to 49 percent in 1990) of the total county population and would generate a greater share of total demand for law enforcement service due to the impacts of the East Boulder Mine Project. In that context, the city and county may reconsider the allocation formula according to which Big Timer contributes to funds to the county for law enforcement services.

Also, the U.S. Forest Service contracts with the county sheriff to patrol campgrounds and other Forest Service property; increased population in Sweet Grass County would generate more forest use and a proportionate (30 to 40 percent) growth in calls for service generated by county residents. It should be noted that Sweet Grass County residents account for only a portion of all users of national forest lands and

facilities. The Forest Service and the county may reconsider the compensation provided the county for patrol services.

Communities which experience rapid growth often experience demand for new public safety and detention programs (e.g., animal control, crime prevention, or special juvenile detention facilities). Growth projected for Sweet Grass County and Big Timber may trigger such demands for programs not currently offered, depending on the success of impact management programs.

**Disaster and Emergency Services.** Although projected increases in population would result in a 30 to 40 percent larger population for the current staff (the sheriff as director and a half-time deputy director) to plan for, organize and notify in an emergency, the projected population impact is not expected to trigger additional staffing needs or needs for new facilities. The county's emergency response plans count on the use of school buses for some evacuee transportation; however, the school bus fleet would grow in response to school enrollment growth and would likely be adequate for increased disaster and emergency needs.

**Road and Bridge.** Additional road and bridge use associated with the project (as outlined in Section 4.10.2) is expected to occur primarily around Big Timber and in the Main Boulder River Valley. The only county maintained road to receive direct impacts from the project would be SG 31, also known as the East Boulder Road. ADT on SG 31 is projected to increase 286 percent over 1989 levels during project construction and 593 percent during project operations. Extensive reconstruction of the road and bridges would need to be accomplished before SG 31 could accommodate the heaviest anticipated loads associated with the East Boulder Mine Project. SG 31 would also require frequent maintenance and snow removal.

As noted above, population in Sweet Grass County is projected to increase from 30 to 40 percent during the six year project startup phase, although 80 percent of this increase in expected to locate in Big Timber. In numerical terms, an additional 239 persons are anticipated to locate in unincorporated portions of the county, which would be a 15 percent increase over the 1990 population in unincorporated areas. It is anticipated that the population choosing to live in unincorporated areas would disperse, resulting in small increases in traffic on most county roads. More substantial impacts on certain county roads could occur if land is subdivided and a substantial number of project-related employees locate within the subdivision. Project-related employees who locate in Big Timber are expected to use county roads primarily for recreational purposes and therefore create minimal demands for road maintenance services. The roads maintained by Sweet Grass County are unpaved, and without corresponding increase in maintenance, additional road use would cause unacceptable deterioration. To provided needed maintenance (i.e., blading), the Sweet Grass County Road and Bridge Department would require one additional employee at an additional annual operating cost for salary, benefits, and support. Although road maintenance effort would increase, the department's existing equipment is expected to be adequate for the heavier workload; however, replacement schedules for existing equipment may accelerate in proportion to the increased use. Many Sweet Grass County bridge structures are near failure and could use upgrading/replacement now. They would be sensitive to even slight increases in frequency of travel which would be expected to accelerate the rate of structure failure.

**Justice Court.** Projected increases in population would increase the caseload of the Sweet Grass County Justice Court. To handle the increase, the court would require an additional clerical support staff to take on administrative tasks now performed by the two present justices. The single courtroom would be adequate for the additional caseload.

**Airport.** Sweet Grass County airport currently provides limited services and facilities. Increased use of the airport generated by 30 to 40 percent projected population increases and by direct East Boulder Mine Project activities may create a demand to clear snow from the runway after major storms, a service which is not now provided. A potential new facility requirement, depending on the actual level of airport use occurring, is a taxi strip.

**Miscellaneous County Services.** Population increases associated with the East Boulder Mine Project would not impact the following county services: predatory animal control, noxious weed control, agricultural extension service, soil conservation, fairgrounds, the golf course (leased to the Overland Recreation Association), or the cemetery. The noxious weed control office is anticipated to receive additional demands for service resulting from additional mine related development. The agricultural extension service and county fairgrounds may receive additional demands for staff services associated with population growth.

City of Big Timber

Impacts of the East Boulder Mine Project on facilities and services provided by the City of Big Timber are based on a total projected population impact in Year 6 of the project of 957 persons and 256 households. This population would reside in the existing city of Big Timber and in adjacent areas which have been identified as the principal areas for annexation, extension of infrastructure, and housing development. During the first six years, the population of Big Timber is projected to increase by about 60 percent as a result of the proposed action, with a projected increase of about 50 percent during the first two years of the project.

**General Government Management and Administration.** Management and administration functions in the city of Big Timber are currently performed by part-time elected officials (mayor and city council) and two full-time employees (clerk and treasurer) who have other primary responsibilities. This method of managing city government appears to have been both efficient and effective during recent years when the city's population has been stable.

However, during the period of rapid growth associated with the proposed action(projected at 50 to 60 percent over 6 years), Big Timber city government would be required to manage several infrastructure construction projects; recruit, hire and train new staff; develop new management systems; and accommodate the municipal service needs of the new residents.

To meet the higher level of management and administrative activity triggered by the proposed action, the city would require one additional general government staff and may require a city administrator or administrative assistant to the mayor and council. These positions would entail additional operating costs for salary, benefits, and support.

**General Government Facilities.** The Big Timber municipal building, a combined office, meeting, and shop facility, is crowded under current conditions. With additional population expected to in-migrate due to the East Boulder Mine Project, the city would require additional general government support, city meetings would be more heavily attended, and equipment maintenance activity would be intensified. To meet these needs would require the development of additional office, meeting, and shop space.

**Law Enforcement.** Big Timber's law enforcement relationship with Sweet Grass County, in which the county sheriff polices the city in exchange for payments over and above taxes paid by city residents, could continue to operate satisfactorily, given the growth projected for Big Timber, if the sheriff increases his patrol staff commensurately.

Since Big Timber would have a larger share of the total county population and would generate a greater share of total demand for law enforcement service, given projected population increases, the city and county may reconsider the city's level of payments to the county for law enforcement services. An adjustment in payments proportional to the projected change in the city's share of population would increase the city's annual operating costs.

**Street Maintenance.** In addition to the traffic increase generated by the 50 to 60 percent project-related population increase, Big Timber streets would receive additional use from project-related county residents, project workers, and vendors as they travel to and from the project site. Given this increase in use, additional effort would be required to maintain about 23 miles of city streets in Big Timber. Although 99 percent paved, the streets were constructed for low traffic and light duty. To provide needed maintenance, additional effort would be required of the city's public works employees requiring one additional employee dedicated to street maintenance at an additional annual operating cost for salaries, benefits, and support. Road maintenance effort would increase, but the city's existing equipment would be adequate for the heavier workload. However, replacement schedules for existing equipment would accelerate with increased use.

**Water Utility.** Approximately 840 residential taps are served by the Big Timber water supply, storage, and distribution system at present. Estimated 1990 population for Big Timber is 1,550. The water system would have to expand to accommodate an estimated increase of 256 residential taps, or about 30 percent more residential taps. This assessment is based on several considerations:

- The nominal capacity of the system is 2,200 persons; this capacity rating is based on an engineering standard and not on usage patterns which may prevail in Big Timber. The projected impact population would increase Big Timber's population to about 2,500 by Year 6 of the East Boulder Mine Project. This would be about 14 percent greater than the system's nominal capacity of 2,200 persons.

- The water system currently does not supply enough water to allow unrestricted domestic irrigation for the existing population which is accustomed to usage rates well above normal, particularly in summer.

- There is little local support for policies or procedures which would restrain demand in order to increase the effective capacity of the existing system.

Big Timber can add some capacity through improvements to the existing system without developing new collection galleries in the Main Boulder River. The city has considered a larger transmission line to the upper gallery to raise maximum flow, new pumps at the lower gallery to increase maximum flow, and additional storage to provide sufficient reserve at times of peak draw down.

Although there is some vacant land within the existing water service area to accommodate new housing in Big Timber, many areas with development potential are unserved at present. Therefore, expanding capacity

to accommodate all projected growth would require new distribution infrastructure as well as augmented supply and storage capacity.

**Sewer Utility.** Based on the following factors, Big Timber's sewage collection and treatment system would have to expand to accommodate an estimated increase of 957 persons and 256 residential taps:

- The nominal capacity of the system is 2,050 persons; this capacity rating is based on engineering standards and not on usage patterns or other circumstances affecting system loads or system capacity which may prevail in Big Timber. The projected impact population would increase Big Timber's population to about 2,500 by Year 6 of the East Boulder Mine Project. This would be about 22 percent greater than the nominal capacity of the system of 2,050 persons.

- The sewage system has a design flow capacity of 523,000 gallons per day (gpd). Currently, average flow is 434,000 gpd and peak flow is 448,000 gpd. At historical per capita peak flow rates, the remaining design capacity of the system is only about 270 persons, compared to the projected population increase of 257.

- In actuality, the system performs at less than its intended efficiency. The aerated lagoon reaches capacity at or near current peak flows, and higher flows must be actively managed in order to remain within state secondary wastewater treatment standards. To improve performance under existing conditions, there already has been discussion of upgrading the existing emergency holding pond to create capacity for handling peak flows.

Therefore, additional treatment facilities would have to be developed to provide the capacity needed to accommodate projected growth.

In addition, it may be necessary to develop unserved land areas adjacent to the existing service area in order to provide adequate new housing in Big Timber. To serve these ares, Big Timber would have to develop new collection infrastructure as well as treatment capacity.

**Solid Waste Collection and Disposal Utility.** Big Timber is in the process of developing a new solid waste disposal landfill and expects the facility to be in place in early 1991. With the new landfill in operation, Big Timber would have sufficient capacity to handle the projected impact population. However, usage generated by the additional population would shorten the projected life of the new landfill which was sized to provide about 70 years of service for the current population.

The City of Big Timber collects solid waste and operates the only landfill in Sweet Grass County. Handling the additional solid waste stream created by the impact population and the mine operation, which is expected to send about 3,000 cubic yards of waste annually to the landfill, would demand additional effort by Big Timber employees requiring one additional employee and generate additional operating costs for salaries, benefits, and support. The city's two garbage packer trucks, are almost 20 years old and in poor condition. The city needs to replace one truck in 1992 and would require another, larger truck the first year of impact.

The cost of acquiring additional, used equipment needed for disposal operations at the new landfill itself has been built into the project's capital cost. The city will issue $450,000 in revenue bonds to fund the new site,

needed equipment, and closure of the old landfill. The increased use associated with the proposed action would generate additional revenue which would help retire the bonds.

**Parks and Recreation.** The Big Timber city park is crowded under current conditions and is not adequate for the projected increase in population associated with the proposed action. Providing uncrowded park space to accommodate additional population would require acquisition of additional park acreage and development of park facilities to augment the existing four-acre developed park.

Operations and maintenance of existing facilities under conditions of increased use and of any new facilities developed to accommodate increased population will involve additional city staff effort equivalent to two additional seasonal summer employees, and entail costs for salaries, benefits, and support. Existing city equipment is likely to be adequate for increased operations and maintenance activity on city parks and recreation facilities.

**Library.** The Carnegie Public Library in Big Timber would be able to serve added patrons generated by projected population increases with the existing collection and facility. However, given existing crowding in public use areas, serving additional use would require longer hours, entailing one or two additional part-time staff and higher operating costs for compensation and support.

#### 4.14.2.6 Other Facilities and Services

A variety of jurisdictions provide other public safety, health, welfare and human services upon which residents of Sweet Grass County and the City of Big Timber rely for the existing quality of life. In general, these service providers would be impacted by the total additional population projected to in-migrate to Big Timber and the rest of Sweet Grass County--an estimated 1,196 persons in 319 households, of which 80 percent would be in Big Timber.

Fire Protection

Projected impacts of the East Boulder Mine Project would affect both the Big Timber Fire Department and Sweet Grass County Fire District, technically separate entities which are operated as one agency.

The proposed mine would provide its own fire protection, based on experience at the existing Stillwater Mine. However, the fire protection district would need a substation near the mine, primarily to fight wildfires; would recruit and train volunteers from mine personnel to run the substation, and would incur costs to equip the substation for fighting wild and structural fires.

The projected population impact to Sweet Grass County outside of Big Timber is relatively small and would be spread among several areas. However, if a sufficient number of new residents settle in McLeod, where no substation now exists, a facility would have to built, equipped, and operated there, and new volunteers recruited and trained.

The main fire station at Big Timber would be called upon to deliver fire service to a projected 50 to 60 percent increase in population. Additional service needs could be adequately met with additional volunteers recruited from among new city and county residents and existing equipment at the Big Timber fire station. However, more paid staff time, entailing additional operating costs for salary, benefits, and

support, would be required to maintain equipment subjected to higher levels of use, perform a greater number of fire inspections, and take on additional training and administrative work.

Although existing fire halls and equipment inventories would be adequate to serve projected population levels, the fire protection district historically has adapted to using older, crowded structures and rolling stock which remains in service for extended terms because of limited replacement funds. Therefore, the adequacy of these facilities potentially would be compromised by even modest increases in impact over those projected here.

Hospital and Other Health Care

Sweet Grass Community Hospital in Big Timber could be expected to experience a 30 to 40 percent increase in admissions because of projected additional population in Big Timber and the rest of Sweet Grass County. Approximately 28 percent of existing Sweet Grass County residents use the community hospital; in-migrant population would be expected to use the hospital at an equal or lesser rate, assuming no changes in the present facility.

Although occupancy by medical and surgery patients is 20 percent, the hospital is inadequate for present community needs because the facilities and equipment are limited or outdated and do not meet life safety code standards. The hospital faces an existing dilemma: patient load is too low to justify a new facility; however, without substantial improvements to make the hospital more attractive as a patient care facility the hospital would not increase its patient load. The lack of patient load correlates to a lack of funding required to meet State standards.

Currently, hospital beds not occupied by medical or surgical patients are used by clients of the Pioneer Nursing Home in Big Timber, which is at capacity. With an increase in hospital occupancy, nursing home clients potentially could be displaced.

One physician and two physician's assistants live in Big Timber; the hospital is recruiting a second physician. With an additional physician, Big Timber would have adequate resources to meet the primary medical needs of existing and additional population. Big Timber also would need a full-time dentist to serve the larger population projected due to the proposed action. The Sweet Grass Community Clinic facility itself has space to accommodate an additional physician and a full-time dentist.

Pioneer Nursing Home

The in-migrating population associated with the proposed action is unlikely to include many persons requiring nursing home services. However, some in-migrating employees may bring aged parents. The 48-bed facility is at capacity, and with an increase in occupancy at the hospital where additional nursing home clients are bedded, nursing home demand could potentially exceed capacity if nursing home clients are displaced from hospital beds.

Emergency Medical Services

The Sweet Grass County Ambulance service could experience 30 to 40 percent or greater increase in emergency calls as a result of increased population and increased commuting on I-90, State Highway 298, and the East Boulder River Road. The emergency service team would have to recruit new members who

must be registered emergency medical technicians (EMTs). The new members would not add greatly to the cost of operating the service. Although most population growth is projected to occur in and adjacent to Big Timber, a quick-response team with one additional vehicle may be needed to accommodate the increase in traffic in the Main Boulder River Valley. SPGMR would provide an emergency response vehicle at the mine site, but Sweet Grass County Ambulance would likely be required to train mine employees and integrate them into the organization.

General Impact Considerations for Human Services

The following sections describe the impacts which may face a variety of public safety, health, welfare, and human services if Big Timber and Sweet Grass County grow as projected due to the East Boulder Mine Project. It may be useful to note that the projected impacts originate in some generally observed patterns which emerge in small communities undergoing substantial and rapid growth and change.

In general, the demand for human services from agency providers rises because newcomers generally tend to rely more heavily on formal or institutional sources of assistance than do members of the existing population. The reason for this is that longstanding residents avail themselves of other, informal support systems (e.g., family, friends, church and/or other social organizations). Lacking informal support groups, newcomers turn to the formal agencies instead.

Notwithstanding informal support networks, long-time residents also may seek formal aid more frequently than normal. This occurs because of the higher level of stress experienced by existing residents as they cope with substantial growth and change in a formerly stable environment.

Although the potential exists for higher levels of stress in Big Timber and Sweet Grass County as project-related impacts materialize, the impact planning and management process which is part of the institutional environment in Montana also has the potential to limit the degree of stress experienced by existing residents and newcomers alike. In other words, if mine developers and proponents handle the boom smoothly, there likely will be less stress and less growth in the need for human services.

Another frequently observed phenomena associated with natural resource projects is that job seekers relocate to nearby communities, exhaust their financial resources while waiting to obtain work, and rely on human service agencies and charitable organizations to sustain themselves until they obtain work or relocate to pursue other opportunities.

Welfare and Family Services

Serving the additional welfare and foster care client load which would arise from the projected increase in population in Big Timber and the rest of Sweet Grass County would require at least a 40 percent increase in staff effort, entailing added costs for salaries, benefits, and support. Additional office space would not be required. Because the state is dominant in funding human service programs, providing for a higher level of service in the area of welfare and family services would depend, first, on the availability of funds at the state level and then the ability of local government to provide its share.

Chemical Dependency Program

According to the Rimrock Foundation, the staffing in Sweet Grass County would need to be increased from the current two days per week to full time to accommodate the project-related demand.

Mental Health Program

Although adequate for current needs, the South Central Montana Regional Mental Health Center would need to receive a 30 to 40 percent increase in county and state funds in advance of serving additional clients arising from a 30 to 40 percent increase in population projected for Big Timber and Sweet Grass County because the program is funded annually and has no provision for supplemental appropriations.

Seniors' Programs

As noted above, the population associated with the proposed action is likely to contain few senior citizens. However, two key services for seniors--the dining room at which congregate meals are served and the 12-passenger bus which accesses the seniors' center--have additional capacity and would be able to adequately serve the small increases in the elderly population occurring because of the East Boulder Mine Project.

Daycare Programs

Projected 30 to 40 percent increases in county population would create a commensurate increase in need for daycare capacity. The Montana Department of Family Services considers the current daycare capacity in Big Timber inadequate for existing needs since the two existing centers are full and outstanding daycare needs are going unmet. Therefore, at least a 40 percent increase in child care capacity would be required to adequately serve the population associated with the proposed action.

**4.14.2.7 Public Schools**

The East Boulder Project's impacts on public schools in Sweet Grass County are based on a total projected impact in Year 6 of 179 students in kindergarten through eighth grade and 86 students in high school. Of these, 143 K-8 students and 69 high school students would live in and adjacent to Big Timber. Another 36 K-8 students and 17 high school students would live elsewhere in Sweet Grass County.

The impacts identified for the following public schools are based on projected enrollment levels and the analysis of existing conditions in terms of standards and costs. However, it should be noted that impacts may occur which are not fully accounted for by the assumptions used in this analysis. For example, in-migrating populations may trigger changes in demand for the kind and variety of course a district provides, beyond those which are required; such changes would, in turn, affect student-teacher ratios and per-student costs, since some courses necessitate smaller student-teacher ratios, some require more classroom space, and some require more expensive equipment, supplies, or associated expenses.

Another impact with cost implications which may occur is if schools must, in addition to an increase in the total number of students served, deal with temporary enrollment peaks or higher turnover rates. These conditions are more likely to occur during the construction phase of the project and are difficult to project and quantify with accuracy. For example, a school may add only 20 students to its ANB (average number belonging)--the annual average enrollment statistic which determines school funding. However, total

enrollments may rise above the average levels at points during the year and many more students may enroll and leave as families associated with specialized work forces having short-term work assignments move in and out of the school district. The school would be required to accommodate the maximum number enrolled at any given time and the total number coming and going during the year.

Finally, schools may need to deal with students from more diverse academic backgrounds, students with special needs, and students and parents who have different expectations than local residents.

Big Timber Grade School

Increased enrollment at Big Timber Grade School (BTGS) would be a projected maximum of 179 students in Year 6 of the East Boulder Mine Project, depending on how many families residing in other Sweet Grass County school districts elect to send their children to school in Big Timber. The impact on BTGS would be 179 students if all families residing in the county send their children to school in Big Timber, regardless of where they live. If no children residing outside Big Timber attend BTGS, the impact on BTGS would be 143 students in Year 6.

Attending grade school in Big Timber would be attractive because other districts maintain only one-teacher schools, distances from other rural communities are not extreme, school buses carrying high school students already serve the entire county, and the BTGS has not charged tuition for out-of-district students in the past. On the other hand, parents living in other school districts may prefer the one-teacher school experience for their children or wish to spare their children a longer bus ride.

In fact neither extreme is likely to occur, and the expected impact assumes that BTGS receives 161 additional students by Year 6, an increase of about 49 percent over the current enrollment of 328. This estimate considers several factors: Many parents residing away from Big Timber proper would choose BTGS. Some living in other districts would prefer their home districts. Other families living a distance away from Big Timber actually would reside within the BTGS District's extensive boundaries.

To accommodate an additional 161 students, BTGS would have to provide approximately 12 additional classrooms, 14 teaching staff, support staff, textbooks, equipment and supplies, special programs, food service, and activities, incurring added capital and operating costs. The number of teachers and classrooms required would depend on the distribution of new students among grades. The school district also would incur additional costs for student transportation in the form of payments to the Sweet Grass High School District which owns and operates the school buses serving the county.

The additional enrollment projected for BTGS would absorb existing excess capacity. Although current state accreditation standards technically would allow an additional 172 students, new state standards which will go into effect in 1992 technically would allow only an additional 144 students. Furthermore, these amounts assume that new enrollment would exactly match existing capacity which is spread unevenly among the grades. Such a match-up is unlikely.

Finally, BTGS's effective capacity may be lower than technically permitted by the state because of specific local circumstances and preferences. First, the school's classrooms are physically small. Second, local residents may wish to maintain the current quality of education and teacher-to-pupil ratios by hiring additional teachers.

Grade school enrollment would increase rapidly during the construction and development phases of the East Boulder Project, and BTGS would have to accommodate most of the expected total impact by the third year after the start of construction. In Year 1, BTGS would enroll 78 students, or 48 percent of the total impact. In Year 2, an additional 59 students would enroll, bringing the impact enrollment to 137 students, or 85 percent of total impact. By Year 3, BTGS would serve 157 students not enrolled now, or 98 percent of the total projected impact.

The build-up of enrollment would allow some preparation time for accommodating impacts. BTGS could accommodate the projected impact for Year 1 without additional classrooms. However, the school would experience some crowding and the quality of education would fall below the locally optimal standards which have prevailed in the past. If the addition of impact students causes short-term overcrowding conditions prior to when new facilities can be built, the school may require temporary classroom space.

Although capable of bonding to construct any new facilities required to handle the impact enrollment, the district would incur additional costs associated with planning for the impact-generated facilities and issuing the bonds. Once constructed, new facilities would impose an additional continuing cost for operations and maintenance.

Other Elementary Schools in Sweet Grass County

Projecting increased enrollment at other elementary schools in Sweet Grass County is uncertain for a number of reasons. Being close to employment opportunities at the East Boulder Mine Project would make the McLeod area attractive to immigrating workers; however, there is little or no existing vacant housing, the potential for new housing is uncertain, and the cost of new housing would likely be high. Rural Sweet Grass County areas other than McLeod are more distant from the mine, and housing availability and potentials also are uncertain. Even if workers were to reside in McLeod or other districts, many may choose to send their children to the BTGS instead of their home elementary schools.

Given the projections of immigrating worker residency presented earlier (and the assumptions underlying them), additional enrollment at other elementary schools in Sweet Grass County (McLeod, Grey Cliff, Melville, and Bridge) could be a maximum of 36 students in Year 6 of the East Boulder Mine Project. This assumes that all families residing in elementary school districts outside of Big Timber would send their children to home district schools.

Taken as a whole, the four rural elementary schools in Sweet Grass County would be adequate to accommodate the projected impact of 36 students, assuming matching of enrollment with capacity school by school and grade by grade. On this basis, the schools can accommodate a total of 46 students within locally acceptable standards and 68 students within state accreditation standards.

Because of their close proximity to the East Boulder Mine Project, areas within the McLeod Elementary School District have the potential to attract a disproportionate number of resident workers and families, but the school's capacity to accommodate additional enrollment is limited. With 7 students in 1990-91, and, based on historical student-teacher ratios, the McLeod School could accommodate 7 or 8 additional students by hiring an additional teacher and as many as 27 additional students (or 75 percent of the maximum number of elementary school students projected to reside outside of Big Timber) without being required to expand its physical facilities.

On the other hand, given the uncertainty of housing in rural Sweet Grass County (and particularly in the Main Boulder River Valley) and given the attractiveness of BTGS, it is more reasonable to assume that only 18 elementary students residing in rural Sweet Grass County, or half the maximum projected number, would attend home-district schools. Under these assumptions, a maximum of nine (or 50 percent) would attend McLeod Elementary, an impact the school can accommodate with additional staff. Grey Cliff and Bridge schools physically would be able to accommodate a comparable impact, but would be expected to attract even fewer additional students. Less physical capacity is available at Melville, but as the most distant school of the four from the project site, it is likely to attract the fewest additional students.

The uncertainty surrounding these estimates is clear and must be kept in mind. With available capacity limited, and the tolerance for error small, slight changes in circumstances can alter the expected outcome substantially. For example, if a single subdivision were to be developed in the McLeod area, a much different distribution of impacts could emerge among rural elementary schools than is projected here. As a result, enrollment at McLeod and at other small elementary schools in Sweet Grass County should be monitored closely as the East Boulder Mine Project is developed.

Sweet Grass High School

Accommodating a projected enrollment increase of 86 students at Sweet Grass High School (SGHS) would require additional classrooms and teaching staff, higher levels of service from administrative and support staff, additional textbooks, equipment and supplies, and increased costs for special programs, food service, extracurricular activities, and athletics. The school district also would incur additional costs for student transportation.

The additional enrollment projected for SGHS would absorb existing excess capacity. Although the school was designed for 220 pupils, the school operates best when it is serving 190 to 200 pupils.

Enrollment would increase rapidly during the construction and development phases of the East Boulder Mine Project, and SGHS would have to accommodate most of the expected total impact by the third year after the start of construction. In Year 1, SGHS would enroll 36 additional students, or 42 percent of the total projected impact. In Year 2, an additional 36 students would enroll, bringing the impact enrollment to 72 students, or 84 percent of total impact. By Year 3, SGHS would serve 83 students not enrolled now, or 97 percent of the total projected impact.

The build-up of enrollment would allow some lead time for accommodating impacts. However, SGHS would have to add temporary facilities immediately in order to accommodate the projected impact for Year 1 without experiencing crowding.

Although capable of bonding to construct any new facilities required to handle the impact enrollment, SGHS would incur additional costs associated with planning for the impact-generated facilities and issuing the bonds. Once constructed, the facilities would impose an additional cost for operations and maintenance.

A small proportion of families in-migrating to Sweet Grass County are expected to settle in or near McLeod, and McLeod students would be accommodated by the McLeod school bus which is operating at about 80 percent of its 60-passenger capacity.

#### 4.14.2.8 Local Government Fiscal Conditions

Substantial capital costs and/or operating cost increases would be incurred by Sweet Grass County, the City of Big Timber, Big Timber Grade School and Sweet Grass High School because of East Boulder Mine Project-related families moving into their jurisdictions. McLeod Elementary School also would experience operating cost increases due to mine-related families residing in the school district. Some increases in operating costs to Sweet Grass County would occur as a result of the East Boulder Mine Project itself.

For revenues, Montana's school districts and other local government units depend heavily on property taxes; they are far and away the dominant local source of revenue. Under normal circumstances (i.e., without the effect of "tax base sharing") property within a local government's boundaries is taxed at full taxable value by that local government unit and that local government unit only.

When large-scale mineral development occurs, normal circumstances may change for local government units. Property tax revenues may lag the costs of providing services needed as a result of the development. Government units which do not contain the mineral development may be called upon to provide services to new residents. Montana law addresses these changes through the Hard-Rock Mining Impact Act and the Property Tax Base Sharing Act.[1]

The two acts work in concert. An impact plan developed under the Hard-Rock Mining Impact Act commits the mine developer to pay all increased local government capital and net operating costs resulting from a new mine. And tax base sharing--triggered by an impact plan and implemented under the Property Tax Base Sharing Act--permits the allocation of increased tax base due to the mine to affected local governments, including those which would not normally receive property tax revenue from the development because they do not contain the mine facilities or ore body.

The Impact Plan

The East Boulder Mine Project qualifies as a large-scale mineral development requiring the preparation and approval of an impact plan. The plan must be approved before any development begins under any operating permit issued by DSL.

The impact plan will identify increased capital, operating and net operating costs to affected local governments resulting from the construction and operation of the mine. The project must pay all increased capital and net operating costs. Payments may be made as property tax pre-payments, impact bonds, grants, or other appropriate financing mechanisms. The impact plan also may provide that the developer furnish non-financial assistance, which may serve to forestall or reduce increased local government costs, or to ensure other benefits. The plan must contain a schedule of the developer's impact payments.

The findings of an impact plan also may trigger tax base sharing. If an approved impact plan identifies a jurisdictional revenue disparity, tax base sharing is mandated and must be implemented under the terms of the Property Tax Base Sharing Act, as amended.

[1] See Title 90, Chapter 6, parts 3 and 4 of the Montana Code Annotated and Rules 8.104.101 through 8.104.305 of the Administrative Rules of Montana.

Two actions of the 52nd Montana Legislature have affected impact plans or the impact planning process. First, an amendment to the Property Tax Base Sharing Act known as House Bill (HB) 832 allows an impact plan to modify the tax base sharing formulas specified by statute. Tax base sharing and this amendment are discussed in more detail below.[2]

A second act of the 52nd legislature directly amended the Hard-Rock Mining Impact Act. HB 237 expanded the permissible projects financed by hard-rock mining impact bonds. Previously such bonds were available to finance only education facilities. Under HB 237, bonds can be issued to finance any facility that is owned, operated, or maintained by a local government unit which can be expected to have increased capital and operating costs as a result of the large-scale mineral development. Local government units include a county, city, town, school district or any of the following independent special districts: rural fire, public hospital, refuse disposal, county water, sewer or water and sewer, and park.[3]

Tax-Base Sharing

Montana law allows for sharing of tax revenue among local government units when a hard-rock mine is designated as a large-scale mineral development. With tax-base sharing, affected local government units may be allocated a portion of the total increase in taxable valuation of the mineral development. An affected local government unit can be a county, incorporated city or town, or school district.[4]

Tax-base sharing occurs when an approved impact plan identifies a "jurisdictional revenue disparity." As defined in the Tax-Base Sharing Act, jurisdictional revenue disparity means increased costs to local government units which cannot tax the development because the development is located outside their taxing jurisdictions. The existence of such a disparity is determined by the Hard-Rock Mining Impact Board in an approved impact plan.

If a jurisdictional revenue disparity is identified, the increase in valuation of the mineral development must be allocated among the affected counties, municipalities, and school districts. The statutory allocation formula is based on the place of residence of mineral development employees and their school-age children, as verified in an annual survey conducted by the developer.

If initial allocation occurs before the survey is conducted, it reflects employees' place of residence and students' district of enrollment, as projected by the plan. The allocation formula takes into account all employees of the mineral development, both in-migrating employees and locally hired employees. Tax-base

[2] 52nd Legislature, State of Montana, House Bill No. 832, "An Act Allocating 20 Percent of an Increase in Gross Proceeds Tax to the Local Government Unit in Which the Ore was Located If Certain Criteria Are Met..."

[3] 52nd Legislature, State of Montana, House Bill No. 237, "An Act to Expand the Permissible Projects Financed by Hard-Rock Mining Impact Bonds..."

[4] The statutes which authorize and define the tax base sharing process are the Property Tax Base Sharing Act and the Hard-Rock Mining Impact Act (Title 90, Chapter 6, Parts 3 and 4 of the Montana Code Annotated) and rules for implementation adopted by the Hard-Rock Mining Impact Board are Rules 8.104.101 through 8.104.305 of the Administrative Rules of Montana.

sharing also may affect the allocation of the state's annual metal mines license tax revenue designated for counties and school districts affected by mining projects.

Tax base sharing is triggered and allocated separately in each of three tiers: counties and municipalities; high school districts; and elementary school districts. All municipalities together may receive no more than 20 percent of the valuation allocated among counties and incorporated towns.

Amendments to the Property Tax Base Sharing Act by the 52nd Montana Legislature (HB 832) leave tax base sharing in effect but change certain provisions. First, HB 832 provides for a 20 percent set-aside of the taxable valuation of the ore body (the gross proceeds taxable valuation) to the local government units in which the ore body is located. The provision is intended to establish a minimum allocation for the units and does not prohibit proof by a unit that actual direct impacts would exceed 20 percent of the total impacts of the development.

Second, the amendments provide for some flexibility in the allocation of the tax base remaining after the 20 percent set-aside is assigned. Previously the statutory allocation formula was the sole determinant of how taxable valuation would be allocated. Under HB 832, the impact plan may modify the formula if the modification would ensure a more reasonable correspondence between the allocation of taxable valuation and the occurrence of increased costs resulting from the mineral development.

Allowance For Uncertainty

The ultimate need for local government services and facilities would be affected by many variables. They may be the timing or magnitude of development, the size or characteristics of the available local workforce, or the number of persons moving into the area as a result of development. As the project proceeds, the actual level of some variables may differ from levels projected prior to commencement of development. Also, some commitments made in the impact plan may presuppose specific events or circumstances which may not materialize. The impact planning process makes allowances for uncertainty and change in the progress of a development.

One allowance for uncertainty is that some commitments in an impact plan may be contingent upon the actual occurrence of specific events or circumstances. "If . . . then" provisions in the impact plan allow commitments to be contingent on actual occurrences. Also, the statutes and rules governing the planning process allow for amendments to the impact plan which may be desirable because of changes in circumstances. The plan itself may include conditions under which one or more parties to the plan may initiate an amendment.

Monitoring

The inclusion of contingent language and the provision for amendment assume that there would be some degree of monitoring of the project by the developer and the affected units of local government. Monitoring may be used to trigger changes in implementation foreseen through the inclusion of "if . . . then" language. Or it may be used to demonstrate the need for amending the approved impact plan. Since the content and subsequent fiscal effects described within the impact plan are essentially a negotiated agreement between the East Boulder Mine Project and affected local government units, specific fiscal effects cannot be described at this time with any degree of certainty.

Projected Allocation of Direct Property Tax Revenues

The proposed action would generate direct and indirect increases in local government revenues. Estimates of potential taxable valuation and property tax receipts are presented in Table 4.14-7. Note that there is an 18-month lag between the construction or installation of mine property or the production of metals and the receipt of taxes from the taxable valuation.

Under the assumptions of this analysis, Sweet Grass County, Big Timber, Big Timber Grade School District No. 1, Sweet Grass County High School District, and McLeod Elementary School District No. 29 potentially would receive property tax receipts from one or more of the following sources assuming the effects of tax-base sharing:

- The East Boulder Mine Project's gross proceeds taxable valuation (i.e., the value of the ore or concentrate produced)
- The taxable valuation of land improvements, and equipment associated with the project, other than the mine itself
- The taxable valuation of new homes and businesses indirectly associated with the project development

Of the preceding items, the first two are the direct increase in taxable valuation of the mineral development subject to property tax base sharing. The third item is the indirect increase in taxable valuation which would occur in response to project development but is not subject to tax base sharing.

Estimates of potential taxable valuation and property tax receipts presented in Table 4.14-7 assume that the allocation of taxable valuation would be (1) an 80:20 split between Sweet Grass County and the City of Big Timber, and (2) an 80:20 split between Big Timber Grade School and other elementary school districts.

These assumptions are based on the projections of employee and employee-related student residency developed for this study, which in turn reflect other assumptions underlying this analysis. The projections of employee and student residency have been translated into allocations based on the statutory distribution formula specified in the Tax Base Sharing Act prior to its amendment by the 52nd Legislature.

This analysis has not attempted to project the potential effects of recent amendments to the Tax Base Sharing Act upon the potential taxable valuation and property tax receipts of local government units. However, it is possible to identify conditions under which amounts that have been projected and presented in Table 4.14-7 may be subject to change because of HB 232.

TABLE 4.14-7
EAST BOULDER PROJECT: ESTIMATED DIRECT
PROPERTY TAX REVENUES

| Taxable Valuation ($000s) | Year 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Ad Valorem | $620 | $710 | $3,285 | $4,151 | $4,342 | $3,920 | $3,539 |
| Gross Proceeds | | | | 987 | 1,860 | 2,840 | 2,840 |
| Total | $620 | $710 | $3,285 | $5,138 | $6,202 | $6,760 | $6,379 |

| Property Tax Receipts ($000s) | Year 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Sweet Grass County | | $ 23 | $ 48 | $ 145 | $ 306 | $ 412 | $ 471 |
| General Fund | | 9 | 18 | 55 | 117 | 157 | 180 |
| Road & Bridge Funds | | 5 | 11 | 35 | 73 | 98 | 112 |
| Poor Fund | | 1 | 2 | 7 | 15 | 20 | 23 |
| Other Funds[1] | | 7 | 16 | 48 | 101 | 137 | 156 |
| City of Big Timber | | 5 | 11 | 34 | 71 | 95 | 109 |
| Sweet Grass High School | | 17 | 37 | 110 | 232 | 312 | 356 |
| Big Timber Grade School | | 11 | 24 | 71 | 150 | 202 | 231 |
| McLeod Elementary School[2] | | 0 | 1 | 2 | 3 | 4 | 5 |

Assumptions:
Taxable valuations provided by SPGMR.
Tax base sharing would occur between Sweet Grass County (80%) and Big Timber (20%).
Tax base sharing would occur between Big Timber Grade School (80%) and other elementary schools in the county (20%).
Assessment would occur in the year following construction.
Half of taxes due would be paid in the assessment year, half in the following year.
The 1990-91 mill levy rates are used in these projections.

Note:
[1]Excludes Soil Conservation Fund.
[2]For illustration only, McLeod Elementary is assumed to receive all of the elementary schools' tax base share, and the revenue projection is based on 1990-91 mill levy rate for the McLeod district.
Numbers may not add to totals due to rounding.

First, as noted above, HB 232 ensures a 20 percent set aside of the gross proceeds taxable valuation to local government units containing the ore body. Whether this provision would apply to the circumstances of the East Boulder Project would be determined only by an accepted impact plan. However, under HB 232, a local government unit containing the ore body may wish to invoke the 20 percent set aside provision if it appears likely that its allocation of tax base would not otherwise exceed 20 percent based on either the statutory tax base distribution formula or a modification of that formula.

If the set-aside provision were invoked on behalf of a local government unit containing the ore body, the remaining valuation subject to allocation would be diminished within that government unit's tax base sharing tier if the tier contains more than one local government unit. This would change the amounts of valuation and property tax receipts projected for all local governments within that tier.

Second, HB 232 allows parties to the impact plan to determine a formula which ensures a reasonable correspondence between the allocation of taxable valuation and the occurrence of increased costs resulting from the mineral development. Whether this provision would apply to the circumstances of the East Boulder Project would be determined only by an accepted impact plan. However, under HB 232, the impact plan may modify the distribution formula if it is found by the parties to the plan that an affected local government unit appears likely to receive a tax base share which is either disproportionately higher or lower than the increased costs resulting from the mine when compared with the mine-related revenue potential and mine-related costs of other affected local government units in the same tax base sharing tier.

If the authority to modify the statutory distribution formula were invoked regarding the proposed project on behalf of a local government unit, the projected distribution of valuation and tax receipts would change within that government unit's tax base sharing tier if the tier contains more than one local government unit. This would change the amounts of valuation and property tax receipts projected for all local governments within that tier.

As noted above, the provisions of HB 232 have the potential to change the projected distribution of valuation and tax receipts for any tax base sharing tier which contains more than one local government. Therefore, the projected valuation and tax receipts potentially subject to change, pursuant to HB 232, are those projected for the Sweet Grass County and the City of Big Timber (the county-municipality tier) and those projected for the Big Timber Grade School, the McLeod Elementary School, and other elementary school districts (the elementary school tier) in Sweet Grass County. Projected valuations and property tax revenues for Sweet Grass High School would not change due to HB 232 because the high school is the only government unit of its type in its tax base sharing tier.

The most notable potential for change pursuant to HB 232 is the potential for change in tax base allocation within the county-municipality tier. The statutory formula sets a maximum allocation of 20 percent to all municipalities in this tier. Based on the assumptions in this analysis, Big Timber is projected to receive a dominant share of the mine-related impact. Therefore, the potential exists for the City of Big Timber as a party to the impact plan to seek a tax base allocation which it views as proportionate to the costs induced by the mine-related impact.

As described above, actual tax base allocations may differ from those projected in this section because of amendments made to the Property Tax Base Sharing Act. Actual tax base allocations also may differ from the projections because of other uncertain factors. For example, the impact planning process prior to the commencement of development may produce findings which lead to different allocations. Once mine

development begins, actual population and cost impacts as monitored in affected communities may differ from projections.

As noted previously, the effects of in-migrant populations residing in Livingston and Columbus would be expected to be minimal, based on the assumptions used in this analysis.

State/Local Shared Severance Tax

Montana imposes a metal mines license tax on the gross value of the mineral produced in excess of $250,000[5]. Gross value of production at the East Boulder Mine Project would be subject to taxation at the rate of 1.81 percent of the value of a concentrate shipped to a smelter, mill, or reduction works.

Twenty-five percent of the state's metal mines license tax revenue is allocated to the county in which the mine is located. After reserving 40 percent of the county allocation in a trust reserve account, the remainder is allocated as follows: one-third to the county for planning and economic development activities, one-third for the affected high school district(s), and one-third for the affected elementary school district(s). The trust reserve account may be expended only following a 50 percent reduction in the mine's workforce or following the mine's closure.

Table 4.14-8 presents estimates of annual metal mines license tax payments by the East Boulder Mine Project allocated to affected local government units in Sweet Grass County. Note that local jurisdictions do not begin to receive revenues until Year 4 of the development period.

In HB 232, the 52nd Legislature also amended the statutes governing the disposition of the metal mines license tax. The first amendment affects the allocation of the 25 percent share of the proceeds of the tax dedicated to counties. Previously, 25 percent of the proceeds of the tax were credited directly to the county in which the mine is located. HB 232 provides that the 25 percent county share may be divided among more than one county if more than one county is identified as experiencing fiscal and economic impacts under an approved impact plan.

The second amendment to the statute occurs because of a reference to portions of the Property Tax Base Sharing Act changed by HB 232. No more than 60 percent of the 25 percent county share of the metal mines tax proceeds are to be divided equally among the county (for planning and economic development), the elementary school district or districts in the county affected by the mine, and the high school district or districts in the county affected by the mine. When there is an approved impact plan in effect, these proceeds are to be distributed in a manner similar to that provided for property tax sharing under the Property Tax Base Sharing Act.

This analysis has not attempted to project the potential effects of recent amendments to the statutes governing the disposition of the metal mines proceeds tax upon the distribution of these proceeds among local government units. However, it is possible to identify conditions under which amounts that have been projected and presented in Table 4.14-8 may be subject to change because of HB 232.

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[5] Hard-rock mines that pay metal mines license taxes are not required to pay the Montana Resource Indemnity Trust Tax. Instead, 15.5 percent of the state's metal mines license tax revenue is allocated to the Resource Indemnity Trust Fund.

First, as noted above, HB 232 allows for the division of the 25 percent county share among more than one county if more than one county is identified as affected by the mine in an approved impact plan. Whether this provision would apply to the circumstances of the East Boulder Project would be determined only by an accepted impact plan. However, under LB 232, a local government unit in a county other than Sweet Grass County may wish to establish itself as an affected local government unit. If the impact plan were modified to recognize affected local government units other than those included here, the actual disposition of the metal mines proceed tax would differ from that presented in Table 4.14-8. Note that such a change also would affect the property tax base sharing allocations described above.

Second, HB 232 requires that when an impact plan is in effect, the sub-allocations of the 25 percent county share of the metal mines proceeds tax are to be distributed in a manner similar to that provided under property tax base sharing. Therefore, any of the possible changes in property tax base sharing described previously would potentially affect the intra-county distribution of the 25 percent county share of the metal mines proceeds tax.

Sweet Grass County

The major county fund accounts which would be affected by the East Boulder Mine Project are the general fund, road fund, bridge fund, and poor fund. Other county funds, including the planning fund, would experience impacts as well, due to the increased population base in the county and the demands of assimilating the East Boulder Mine Project and related development. The following are the kind of costs which Sweet Grass County would incur, listed by fund:

- General Fund: increased costs for a higher level of service in general government, including administrative assistance for the legislative branch; higher levels of law enforcement service, including personnel, support, and equipment costs; higher levels of detention service, and potential upgraded detention facilities provided and administered by the county sheriff; and a higher level of justice court service

- Road and Bridge Funds: increased costs for higher levels of road and bridge maintenance service and potential costs for upgrading of bridges which are already near failure

- Poor Fund: increased costs to provide a higher level of welfare and family services, including meeting additional unfunded foster care needs

- Other Funds: increased costs to provide a higher level of county planning services; higher levels of service in the emergency medical/ambulance, chemical dependency, and mental health programs; and potential additional services and potential improvements at the airport

TABLE 4.14-8

EAST BOULDER PROJECT: ESTIMATED METAL MINES LICENSE TAX REVENUES TO SWEET GRASS COUNTY

| | Year | | | | | | |
|---|---|---|---|---|---|---|---|
| Amounts ($000s) | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Gross Proceeds | $ 0 | $ 0 | $ 0 | $21,650 | $61,750 | $94,417 | $94,417 |
| Tax Paid | 0 | 0 | 0 | 0 | 591 | 1,181 | 1,709 |
| Sweet Grass Co Allocation (25%) | 0 | 0 | 0 | 0 | 148 | 279 | 427 |
| Trust Reserve Account (40%) | 0 | 0 | 0 | 0 | 59 | 112 | 171 |
| Affected Jurisdictions (60%) | 0 | 0 | 0 | 0 | 89 | 168 | 256 |
| Sweet Grass County | 0 | 0 | 0 | 0 | 6 | 11 | 17 |
| Big Timber | 0 | 0 | 0 | 0 | 24 | 45 | 68 |
| Sweet Grass High School | 0 | 0 | 0 | 0 | 30 | 56 | 85 |
| Big Timber Grade School | 0 | 0 | 0 | 0 | 24 | 45 | 68 |
| Other Elementary Schools | 0 | 0 | 0 | 0 | 6 | 11 | 17 |

Assumptions:
- Gross proceeds derived from taxable valuations provided by SPGMR.
- Tax rate of 1.81 percent on gross proceeds greater than $250,000.
- Sharing of 1/3 for counties and municipalities would occur between Sweet Grass County (80%) and Big Timber (20%).
- Sharing of 1/3 for elementary schools would occur between Big Timber Grade School (80%) and other elementary schools in the county (20%).
- Taxes paid in the year following production.

Note:
Numbers may not add to totals due to rounding.

Besides the estimated property tax and metal mines tax revenues presented in Tables 4.14-7 and 4.14-8, additional revenues would accrue to Sweet Grass County from new residential and commercial property taxes. With regard to metal mines tax revenues, note that funds reserved in the county's hard-rock mining trust reserve account may not be expended from the trust until the mine closes or experiences a 50 percent reduction in work force; therefore, these funds are not available for current year purposes. The additional allocation of metal mines tax funds to the county may be expanded only for planning and economic development purposes. Other county revenues which would be generated by an increased population base include various taxes and fees on motor vehicles, recreational vehicles, and motor homes (assuming no change in the current mill levy); a portion of the gas tax allocation, and licenses, fines, permits, and user fees which are accounted for in various funds according to statute and local practices.

Although specific costs are uncertain, the pattern of build-up in population versus the growth in revenues (given the timing of the construction process and lags in realizing taxable valuation and tax receipts) suggests that the Sweet Grass County fund accounts would experience impact deficits during the initial three or more years of the East Boulder Mine Project. In general, increased levels of service would be demanded in the first years and property tax revenues from the mineral development tax base would not be received for nearly two years following appraisal.

City of Big Timber

The city accounts which would be affected by the East Boulder Mine Project are the general fund, the water funds, the sewer funds, and the solid waste funds. The following are the kind of costs which the City of Big Timber would incur, listed by fund:

- General Fund: costs for a higher level of service in general government management and administration staff and potential costs for upgraded general government facilities, for increased planning services, for a higher level of law enforcement service, for a higher level of street maintenance and potential equipment upgrades, for additional parks and recreation facilities and a higher level of parks and recreation operations and maintenance, and a higher level of library service

- Water Funds: costs for substantial additions to water supply, storage, and distribution capacity and for a higher level of public water service, including operations, maintenance and depreciation

- Sewer Funds: costs for substantial additions to sewage collection and treatment capacity and for a higher level of wastewater service, including operations, maintenance, and depreciation

- Solid Waste Funds: costs for a higher level of solid waste collection and disposal service, including operations, maintenance, and depreciation

Besides the estimated property tax revenues presented in Table 4.14-7, additional revenues would accrue to the City of Big Timber from new residential and commercial property taxes. Other city revenues which would be generated by an increased population base include various taxes and fees on motor vehicles, recreational vehicles, and motor homes (assuming no change in the current mill levy), a portion of the gas tax allocation, and licenses, fines, permits, and user fees which are accounted for in various funds according to statute and local practices.

As with the county, although specific costs are uncertain, the pattern of build-up in population versus the growth in revenues suggests that Big Timber's fund accounts would experience impact deficits during the initial three or more years of the East Boulder Mine Project. In general, the timing of the mine development process is such that increased levels of service would be demanded in the first years of the project while property tax revenues from the mineral development tax base would be available later because of the gradual build-up in taxable value and lags in the assessment of property and receipt of taxes.

To some extent, the same is true of fee-based services, such as water, sewer, or solid waste. Although there is no significant time lag in collection of fees, facilities must be in place and the service available before fees can be collected.

Big Timber Grade School

The East Boulder Mine Project would affect the BTGS general fund primarily with additional impact on the transportation fund. If bonds are issued to build new facilities, the district's debt service fund also would be affected:

- General Fund: costs for additional teachers; textbooks; equipment and supplies; higher levels of service from administrative, support, and custodial staff; utilities; special programs; activities; athletics; and food services

- Transportation Fund: per-student costs for additional ridership on SGHS buses

- Debt Service Fund: costs for principal and interest on bonds to finance new facilities

The district also may incur costs for temporary classroom facilities in early years of the project, as well as costs for planning for growth and issuing bonds.

The principal source of revenue for an elementary school is the annual entitlement from the Montana School Foundation Program. Funds are allocated to the school based on the "average number belonging" (or ANB). ANB for the current school year is the average enrollment for the calendar year which covers the first half of the previous school year and the last half of the school year prior to that.[6] Foundation payments would be based on current schedules reflecting the effects of HB 28, the school finance reform legislation of 1989. The district also would receive some additional revenue for additional students with special needs.

Under the Tax-Base Sharing Act, BTGS would be eligible to receive a portion of the East Boulder Mine Project mineral taxable valuation, as well as an allocation from the county Metal Mines License Tax fund. Estimates of these revenues are presented in Tables 4.14-7 and 4.14-8. Note, however, that it is not appropriate to assume that metal mines license tax revenues allocated to a local school district is necessarily available for current year or general purpose expenditures. The governing body of the school district receiving metal mines license tax funds has the authority to hold money in reserve for any period of time it may wish. For example, school trustees may choose to accumulate money in the reserve, accruing interest,

[6] That is, the 1990 ANB, used to calculate the foundation program entitlement for the 1991-92 school year budget, consists of the average enrollment for the first half of the 1990-91 school year and the last half of the 1989-90 school year.

as a safeguard against temporary shutdown or a significant drop in production or metal prices, either of which could reduce the tax base of the district by reducing the value of the gross proceeds. Besides these revenues, the school district would be able to tax valuation added by new residential and commercial property. The allocation of motor vehicle fees to the school district also would increase roughly in proportion to the growth in number of persons immigrating to the district.

Although specific costs are uncertain, the pattern of build-up in population versus the growth in revenues suggests that the school district would experience impact deficits during the initial three or more years of the East Boulder Mine Project. In general, the timing of the mine development process is such that increased levels of service would be demanded in the first years of the project while increase per student entitlements and property tax revenues from the mineral development tax base would be available later because of lags in the system of revenue generation.

Other Elementary Schools in Sweet Grass County

Based on the assumptions described in Section 4.14.1.3, McLeod Elementary School would receive nine additional students due to the East Boulder Mine Project. This would directly affect the school's general fund in that the district would incur costs for additional staff, textbooks, and supplies. In-migrating students would increase the district's foundation entitlement.

The district also would be eligible, under the Tax Base Sharing Act, to receive a portion of the East Boulder Mine Project taxable valuation and a share of the metal mines tax proceeds earmarked for affected elementary schools. (For purposes of illustration only, a projection of estimated maximum potential direct property and metal mines tax proceeds to the McLeod district was presented in Tables 4.14-7 and 4.14-8.) As noted previously, it is not appropriate to assume that metal mines license tax revenue allocated to a local school district is necessarily available for current year or general purpose expenditures. The district also would be able to tax any additional residential property which may be developed within its jurisdiction.

Although specific costs and revenues are uncertain, the pattern of build-up in population versus the growth in revenues suggests that the school district would experience some net costs during the initial year or two of the East Boulder Mine Project because of lags in the system of revenue generation.

Other elementary schools in Sweet Grass County (Grey Cliff, Melville and Bridge) may also receive additional students due to the East Boulder Mine Project. The cost and revenue effects of the additional students would behave similarly to those described for McLeod Elementary School, but they would be at a smaller scale.

However, the uncertainty surrounding the projected impacts on other elementary schools in Sweet Grass County (as described in Section 4.14.1.3) must be kept in mind. Since slight changes in circumstances could produce a different outcome from that projected, enrollment at McLeod and at other small elementary schools in Sweet Grass County should be monitored closely as the East Boulder Mine Project is developed in order to properly match project-related revenues and costs.

Sweet Grass County High School

The East Boulder Mine Project would affect the SGHS general fund primarily, with additional impact on the transportation and the bus replacement fund. If bonds are issued to build new facilities, the district's debt service fund also would be affected:

- General Fund: costs for additional teachers; textbooks; equipment and supplies; higher levels of service from administrative, support, and custodial staff; utilities; special programs; activities; athletics; and food services

- Transportation and Bus Replacement Fund: costs for additional students on existing buses and potential costs for bus acquisition and depreciation and for operation and maintenance of new buses

- Debt Service Fund: costs for principal and interest on bonds to finance new facilities

The district also may incur costs for temporary classroom facilities in early years of the project, as well as costs for planning for growth and issuing bonds.

The principal source of revenue for a high school is the annual entitlement from the Montana School Foundation Program. Funds are allocated to the school based on the ANB.[7] Foundation payments would be based on current schedules reflecting the effects of HB 28, the school finance reform legislation of 1989. The district also would receive some additional revenue for additional students with special needs. As noted previously, it is not appropriate to assume that metal mines license tax revenue is available for current year or general purpose expenditures.

SGHS would derive property tax revenues from the full taxable valuation of the East Boulder Mine Project, as well as the full allocation of metal mines taxes available for affected high school districts. Estimates of these revenues were presented in Tables 4.14-7 and 4.14-8. In addition, the school district would be able to tax valuation added by new residential and commercial property. The allocation of motor vehicle fees to the school district also would increase roughly in proportion to the growth in number of persons immigrating to the district.

Although specific costs are uncertain, the pattern of build-up in population versus the growth in revenues suggests that the school district would experience impact deficits during the initial three or more years of the East Boulder Mine Project. In general, the timing of the mine development process is such that increased levels of service would be demanded in the first years of the project while property tax revenues from the mineral development tax base would be available later because of the gradual build-up in taxable value and lags in the assessment of property and receipt of taxes.

#### 4.14.2.9 Attitudes, Opinions, and Lifestyles

This section describes the potential effects of the proposed action on attitudes, opinions, and lifestyles of Sweet Grass County residents.

[7] ANB is described above in the section of Big Timber Grade School.

Effects on attitudes, opinions, and lifestyles are discussed under the following categories:

- Residents of Sweet Grass County and the City of Big Timber
- Residents of the Main Boulder River Valley
- Residents of the East Boulder River Valley
- Recreational users of the East Boulder River area of the GNF

These categories are used for the purpose of analysis; they are not mutually exclusive. For example, residents of the Main Boulder and East Boulder River Valleys are also residents of Sweet Grass County, hence they would share in the effects described at the county level. Similarly, some residents of the city, county, and Main Boulder and East Boulder River Valleys may also be recreational users of the East Boulder River area of the GNF. The effects identified in this section may not include all group members, nor would the proposed action affect all group members equally. The effects are to be reflective of the prevailing attitudes, opinions, and lifestyles of the particular group.

Residents of Sweet Grass County and the City of Big Timber

The substantial population growth that would occur over a relatively short time in Sweet Grass County and Big Timber would result in changes in the daily activities and interactions for some Sweet Grass County and most Big Timber residents at every level. Local government, businesses, social, religious, civic and service organizations, families, and individuals would be required to interact with more and different people on a daily basis. Increasing contact with newcomers will be welcomed by some, particularly those that have an economic interest in growth or those that view additional employment opportunities as a means of allowing youth to remain in the county. Other residents may be dissatisfied with the changes accompanying the proposed action due to a resistance to change described in the sociological research literature concerning Sweet Grass County. Residents who may experience dissatisfaction would be particularly those who might not share in the project's benefits, such as retired persons, non-residents who have second or vacation homes in the county, or residents living in outlying portions of the county who rely on Big Timber for goods and commercial, governmental, and health services.

Although many of the newcomers associated with the proposed action would very likely be culturally and demographically similar to existing residents of the county, there is a potential for dissatisfaction among some existing city and county residents as they are required to interact with newcomers who appear to display different lifestyles and values. This potential is heightened by the aforementioned resistance to change, the relatively stable social conditions in the county, and the absence of previous hard-rock mining activity. The considerable number of local hires projected for the proposed action would aid in the integration of new project workers into the social fabric of the community. The potential for dissatisfaction would diminish as newcomers become integrated into the community.

Population growth would also result in physical changes in the City of Big Timber including the development of new land area, houses, businesses, and public facilities. There would also be substantial increase in the number of people using public and commercial facilities (i.e., post office, county and city facilities, schools, stores, recreation facilities, etc.).

Proliferation of residential and commercial development in unincorporated portions of the county would also result in dissatisfaction among Sweet Grass County residents, particularly if development occurs in portions of the county that have hitherto been in agricultural or recreation uses or areas that have scenic value.

The effects of the proposed action on attitudes, opinions, and lifestyles of county residents would be dependent largely on the success of the impact plan developed under the provisions of the Montana Hard Rock Mining Impact Act. The impact plan would be designed to focus growth in and near Big Timber, and to provide the city, county, and school districts with the facilities and operational resources and staff necessary to efficiently and effectively accommodate the substantial levels of population growth associated with the proposed action. The success of the impact plan would be dependent on its ability to:

- Focus population growth in and around the City of Big Timber

- Prevent substantial development related to the proposed action from occurring in currently undeveloped portions of the county

- Facilitate the subdivision of land and the development of housing which would be in place in time to meet the demand associated with the proposed action

- Facilitate the development of the required public facilities and operational resources and staff in time to meet the demand associated with the proposed action

- Encourage the development of expanded management resources at both the city and county level

To the extent that the impact plan is successful and population growth is accommodated in an efficient and effective manner, the potential for dissatisfaction associated with change would be diminished.

Residents of the Main Boulder River Valley

In addition to those effects described above, attitudes, opinions, and lifestyles of residents of the Main Boulder River Valley are most likely to be affected by two factors associated with the proposed action: the project-related increase in traffic on State Highway 298 and the potential for substantial development to occur in the Main Boulder River Valley.

Increases in traffic on State Highway 298 associated with the proposed action are described in Section 4.10. The project-associated increase in traffic would result in the potential for increases in accidents and congestion and conflicts between project-related traffic and agricultural uses on the highway. To the extent accidents, congestion, and conflicts occur, dissatisfaction among Main Boulder River Valley residents would be anticipated. Mandatory busing and the development of successful traffic safety measures and traffic reduction policies would reduce the potential for dissatisfaction.

The Main Boulder River Valley is considered a scenic area best suited to low-density land uses. Substantial development in the East Boulder River Valley would result in considerable dissatisfaction among valley residents as well as residents of the county in general. The attractiveness of the Main Boulder River Valley to project employees would be considerable because of the area's proximity to the mine and because of the valley's natural beauty. The perception that development might occur has resulted in an organizational response from lower Main Boulder River Valley residents in the form of an initiative to develop more stringent land use controls for the lower Main Boulder River Valley. Successful implementation of the impact plan coupled with the relatively high cost of land and disincentives provided by the Sweet Grass County Growth Policy Plan (and potential future land use regulations) would discourage development in the Main Boulder River Valley.

East Boulder River Valley

Potential effects of the proposed action on the attitudes, opinions, and lifestyles of East Boulder River Valley residents would result primarily from the project-related traffic on the East Boulder Road (SG 31 or Valley Route).

The transportation impacts associated with the use of SG 31 for access to proposed action facilities are described in Section 4.10. Use of SG 31 for project access would result in considerable dissatisfaction for residents of the East Boulder River Valley. The East Boulder River Road issue generated the greatest number of responses during the scoping process. The concerns associated with such use include the potential for noise, accidents, and dust, particularly since the existing road is very close to a number of residences. Many residents are on record as opposing use of the road for access and believe that such use would be a threat to their existing lifestyles. Given the substantial opposition, use of the East Boulder River Road for access can be anticipated to result in organizational and institutional responses from East Boulder River Valley residents.

Recreational Users of the East Boulder River Area of GNF

Effects of the proposed action on existing recreational uses in the East Boulder River Valley area of GNF are described in Section 4.13. The traffic, noise, visual intrusion, and general activity associated with the proposed action can be anticipated to result in dissatisfaction among some recreation users of the East Boulder River Valley area of GNF. Many national forest users view industrial activities as incompatible with the recreational experience. Dissatisfaction would be expected to result in diminished recreational use in the East Boulder River Valley, returning to near current levels (See Table 3.13-2) after project closure and reclamation.

#### 4.14.2.10 Temporary or Permanent Closure or Reduction in Workforce

During mine development and operations, the proposed action would provide a significant source of employment, income, and tax revenue. If the project were to close prematurely or experience major reduction in workforce, employees would lose their jobs, increasing unemployment and decreasing personal and governmental income. Actual effects would depend on the length of closure, the reduction in workforce, and the unemployment benefits available to unemployed workers.

If operations proceed as currently planned, mining activities at the East Boulder Mine Project would have a projected 27-year life. When the mine is closed, the affected area would lose about 600 high-paying jobs. To help mitigate the fiscal and economic impacts resulting from mine workforce reduction and mine closure, Montana statutes authorize the establishment of a county Hard-Rock Mining Trust Reserve Account funded by an allocation from the Metal Mines License Tax.

Funds held in the account may not be appropriated until a mining operation has permanently ceased all mining-related activity or the number of persons employed full-time in mining activities by the mining operation is less than one-half of the average number of persons employed full-time in mining activities by the project during the immediately preceding five-year period. When such circumstances occur, the county may appropriate the funds in the account to address both economic and fiscal impacts of closure or a reduction in force. One-third of the funds is earmarked for impacts occurring to affected schools, while the

remainder is available for impact mitigation for other affected local governments, for economic development, and for tax relief.

#### 4.14.2.11 Civil Rights, Including Opportunities for Women and Minorities

Chevron Resources Company, which is the parent company for SPGMR, has a corporate policy of equal opportunity in employment. This policy is intended to ensure that no employee will be discriminated against on the basis of race, color, religion, sex, national origin, age, handicap, or status as a veteran of the Vietnam era. Chevron Resources Company has established affirmative action plans which include positive goals and timetables for achieving a proper representation for minorities and women in the company's workforce (Daniel 1989). Currently SPGMR has an operating affirmative action plan at the Stillwater Mining Company operations. The company would develop and implement an affirmative action plan for the East Boulder Mine Project (Lawson 1990). A properly developed and implemented affirmative action plan should protect workers' civil rights and ensure employment opportunities for women, minorities, and employees, thus avoiding potential negative effects to civil rights of workers and prospective workers associated with the proposed action.

### 4.14.3 Alternative 3 - Modified Tailing Impoundment Configuration

The tailing impoundment alternatives would not result in socioeconomic effects measurably different than those associated with the proposed action unless a reduction in the amount of tailing that could be contained resulted in a corresponding reduction in the amount of ore that could be mined and an acceleration of project closure. Under such a scenario, the socioeconomic effects of project closure would also be moved forward in time.

### 4.14.4 Alternative 4 - Alternative Access Road/Power Line Alignments

Bench Route (R2). The Bench Route would move traffic away from existing housing in the East Boulder River Valley, reducing traffic hazards and dust and noise effects. Consequently, the Bench Route is likely to result in less dissatisfaction among East Boulder River Valley residents than the proposed Valley Route, which is addressed in Alternative 2. However, the Bench Route would disturb existing undeveloped lands, and would result in a substantial increase in traffic through the valley. The Bench Route would also bisect some irrigated crop and grazing lands; therefore, dissatisfaction could be expected to occur as a result of this alternative.

Bench/Valley Route (R4). The Bench/Valley Route would be in close proximity to fewer residents than the proposed Valley Route, but would be in close proximity to more residences than the Bench Route. This route would bisect fewer irrigated crop lands than the Valley Route but more than the Bench Route, and would bisect more irrigated grazing land than the Valley Route, but less than the Bench Route.

Based on the proximity of the three routes to existing residences and the amount of irrigated crop and pasture land that would be disturbed, it would be anticipated that the Valley Route would generate the highest levels of dissatisfaction among East Boulder River Valley residents, the Bench Route would generate the lowest levels, with the Bench/Valley Route falling in between.

### 4.14.5 Alternative 5 - Power Supply Corridor Systems

The power supply alternatives would not result in socioeconomic effects measurably different than those associated with the proposed action.

### 4.14.6 Alternative 6 - Water Treatment Alternatives

Implementation of a water treatment alternative would result in no additional impacts beyond those described for Alternative 2 in Section 4.14.2.

### 4.14.7 Alternative 7 - Proposed Action with Modifications

No additional mitigation measures for socioeconomics have been proposed by DSL or GNF; therefore, the impacts under this alternative would the same as those identified for Alternative 2 - Proposed Action (Section 4.14.2).

### 4.14.8 Alternative 8 - Twin Production Adits

Implementation of Alternative 8 should result in no change in socioeconomic impacts from those described in Alternative 2. However, there could be some difference in taxable valuation if SPGMR does not purchase a new tunnel boring machine.

### 4.14.9 Cumulative Impacts

With the exception of the increases induced by the proposed action, economic activity in Sweet Grass County is anticipated to remain fairly constant at current levels. The Stillwater Complex Integrated Resource Analysis (IRA), described in Section 2.6 of this document, lists potential projects of concern. In general, the habitat and range improvement projects and the timber and firewood sales projects are a continuation of activities that normally occur on public lands and as such are not anticipated to result in any new effects on socioeconomic conditions in Sweet Grass County. The same can be said for the anticipated Pegasus and Pathfinder Explorational Drilling Projects near Independence, (designated as projects M5 and M6 in Section 2.6) except that these projects may result in some temporary displacement of recreation users of these areas of the National Forest.

The Stillwater Plateau Minerals Exploration, Mining, and/or Processing Projects (including projects designated as M102 through M106 in Section 2.6) are occurring or are anticipated to occur in the Custer National Forest portion of the IRA. These projects would have little effect on socioeconomic conditions in Sweet Grass County, as a result of distance and access.

## 4.15 NOISE

### 4.15.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. These activities are expected to last approximately 18 months. Activities consist of the extraction of a bulk ore sample, the determination of mining conditions and related cost factors, and the completion of an underground diamond drilling program from which ore reserves will be

estimated. During exploration, an 18,550-foot tunnel will be driven to intersect the ore-bearing zone. A tunnel boring machine approximately 16 feet in diameter will be used to bore this tunnel. Short-term noise impacts will occur as this boring machine begins tunneling and the impacts will decrease as the boring machine goes deeper into the tunnel. Noise impacts will also result from mining support vehicles. Refer to Table 4.15-1 for noise levels associated with typical construction and operation vehicles which will be used on this project. The worst-case noise level associated with all the equipment operating at the same time is approximately 100dBA at 50 feet. A common estimation of sound attenuation with distance is a reduction of the noise level of 6dBA with each doubling of distance. For example, a noise level of 100dBA at 50 feet would be 94dBA at 100 feet and 88dBA at 200 feet. Using this estimation along with the worst-case operation noise level of 100dBA, the noise levels will be reduced to 55dBA at about 9,600 feet (approximately 1.8 miles) from the noise source. A noise level of 55dBA has been identified by the EPA to protect the public from outdoor activity interference (EPA 1974). Using EPA's assumptions about noise disruption, persons engaged in recreational activity within approximately 1.8 miles of the East Boulder permit area may find that noise from the mine disturbs their recreational experience.

### 4.15.2 Alternative 2 - Proposed Action

Construction. Noise impacts generated during construction activities would include noises associated with blasting during adit construction, and construction vehicle traffic. Construction blasting can result in short-term noise levels of up to 125 dBA at 900 feet. This blasting noise would decrease as the adit goes deeper. Table 4.15-1 presents noise levels associated with construction and operation equipment which would be used for this project. The worst-case noise level associated with all the equipment operating simultaneously would be approximately 100dBA at 50 feet. Noise levels associated with the construction of access roads and transmission lines would be temporary and transient in nature. Construction equipment such as bulldozers, front-end loaders, haul trucks, scrapers, and graders would generate noise levels of approximately 100dBA at 50 feet.

Operations. Noise impacts are expected from mining and milling activities, mine and mill support vehicles, commuter and access road traffic, and helicopters. Noise generated by mining activity would be largely contained within the underground workings. Noise generated during the milling process would generally be contained within the mill building. Truck and commuter traffic would affect residences along the access route. Heavy trucks produce noise levels of about 85dBA at 50 feet. Using the attenuation estimation of 6dBA for each doubling of distance, the noise level produced by a heavy truck would be 55dBA at 1,600 feet (approximately 0.3 miles). Therefore, residences less than 1,600 feet from the access road activity would experience interference with outdoor activity. A number of residences are located less than 1,600 feet from SG 31, and residents at these locations would likely be disturbed by truck traffic.

Noise levels generated by the adit ventilation fans would be approximately 95dBA at 100 feet (Parker 1987). These would be placed inside the adits, including those in the Placer Basin permit area, following construction to minimize noise levels. The Absaroka-Beartooth Wilderness is located approximately 1.5 to 2 miles south of the Placer Basin permit area and less than 0.5 miles from FS 140 (access road to the Placer Basin permit area). Noise levels associated with mine-related activities would likely attenuate to below background noise levels within approximately 1.5 to 3 miles. Therefore, it is likely that noises generated under this alternative would be audible in the wilderness areas to the south.

TABLE 4.15-1

NOISE LEVELS ASSOCIATED WITH CONSTRUCTION EQUIPMENT

| Equipment Type | Quantity of Equipment | Sound Level at 15 Meters (50 feet) |
|---|---|---|
| Vehicles (pickups) | 23 | 80 |
| Heavy Truck | 3 | 85 |
| Dozer | 2 | 89 |
| Fire Truck | 1 | 85 |
| Ambulance | 1 | 80 |
| Loader | 2 | 89 |
| Compactor | 1 | 80 |
| Surface Grader | 2 | 85 |
| Maintenance Trucks | 6 | 90 |
| Forklifts | 4 | 90 |
| Service Trucks | 5 | 92 |

Source: Construction Engineering Research Laboratory 1978

Helicopter noise data obtained from published data indicate a range of noise levels generated by helicopters of 76 to 85 dBA at 1,000 feet (Science Applications, Inc. 1980). However, the impact of the helicopter noise to Boulder River Valley would be minimal since SPGMR would only use helicopters in case of emergencies and possibly for monitoring wildlife populations. SPGMR anticipates helicopters would originate from Bozeman, taking a direct route to the mine. Only residents along this flight path would be impacted when the use of helicopters is necessary.

Closure and Reclamation. Temporary noise impacts would result from closure and reclamation activities. Construction vehicles would contribute the major portion of the noise impacts. Noise levels and attenuation distances would be similar to those described for construction and operations.

### 4.15.3 Alternative 3 - Modified Tailing Impoundment Configuration

Noise impacts would result primarily from the construction of the tailing dam and would be similar to the noise impacts from construction vehicles described for Alternative 2. Noise impacts during the operation of the tailing impoundment area would result from continued construction and operation of vehicles and the transport of tailing to the impoundment area. Noise impacts from the construction and operation vehicles would be similar to those described for Alternative 2.

### 4.15.4 Alternative 4 - Alternative Access Road/Power Line Alignments

The noise impacts for the Bench Route (R2) and the Bench/Valley Route (R4) would be similar. Impacts are discussed below.

Construction. Temporary noise impacts would result from the construction or improvement of the Bench Route and the Bench/Valley Route access roads. Refer to Table 4.15-1 for noise levels associated with typical construction equipment. This activity would likely disturb some residents of the East Boulder River valley.

Operations. Noise impacts from the operation of the access roads would consist of commuter traffic (buses or passenger cars) and haul trucks. Noise levels from passenger cars are in the range of 60 to 80dBA at 50 feet. Busses and haul trucks noise levels are approximately 85dBA each. These noise levels would be attenuated to 55dBA at 1,600 feet from the source. Therefore, residences less than 1,600 feet from the access road would experience interference with outdoor activity. Few residences are located within 1,600 feet of the alternative road routes, but the persons living at these locations would likely be disturbed by truck traffic.

### 4.15.5 Alternative 5 - Power Supply Corridor Systems

The noise impacts for each power supply alternative would be similar. Impacts are discussed below.

Construction. Noise impacts from the construction of the power transmission lines would result from construction equipment. Refer to Table 4.15-1 for noise levels associated with these construction vehicles. Residences within about 1.8 miles would be temporarily impacted from this construction activity.

Operations. The proposed 69-kV electrical power transmission line may produce a soft hissing and cracking sound in wet weather. In fair weather, these noises are virtually inaudible. These noise levels would be at, or below, the background noise levels measured in the project area (Black 1983), and would therefore be a minimal noise impact.

Closure and Reclamation. Temporary noise impacts would result from closure and reclamation activities associated with this alternative, with most impacts associated with construction vehicles used to remove power poles and collect distribution lines, if the power line is to be removed. (This decision would be left to Park Electric).

### 4.15.6 Alternative 6 - Water Treatment Alternatives

Implementation of any of the three water treatment alternatives would result in no additional impacts beyond those described for Alternative 2 in Section 4.15.6 with the exception the treatment process may generate noise during operations which would continue possibly beyond the life of mine until cessation of wastewater treatment.

### 4.15.7 Alternative 7 - Proposed Action with Modifications

The mitigation measures outlined in Chapter Two which apply to noise involve the use of upgraded muffler systems on dedicated facility construction and operation equipment and vehicles, the use of radar detector

back up beepers, and the placement of ventilation fans far enough inside the shafts so as to minimize noise near wilderness areas. Upgraded muffling systems can generally reduce noise levels by 6 to 8 DBA. The use of radar detector back up beepers allows the sounding of the audio warning signal only when necessary.

### 4.15.8 Alternative 8 - Twin Production Adits

Noise impacts under Alternative 8 are projected to be the same as those described in Alternative 7, with the exception that noise levels would be reduced on the East Boulder Plateau since construction and operations activities would not occur at Brownlee Creek, and the minimization of some impacts as a result of mitigations.

#### 4.15.8.3 Closure and Reclamation

Temporary noise impacts would result from closure and reclamation activities. Construction vehicles would contribute the major portion of the noise impacts. Noise levels and attenuation distances would be similar to those described for construction and operations.

### 4.15.9 Cumulative Impacts

Cumulative noise impacts were estimated by adding logarithmically the measured background noise levels to the construction and operation impacts. A simplified method for summing two or more noise sources is as follows:

| When two noises differ by: | Add the following to the higher values |
|---|---|
| 0 - 1 DBA | 3 |
| 2 - 3 DBA | 2 |
| 4 - 9 DBA | 1 |
| 10 or more DBA | 0 |

When it is necessary to add more than two sound levels together, the levels are ranked in ascending order, and then added together two at a time starting with the lowest two levels.

Measurements of background noise levels in the study area range from 52 to 62dBA. Construction and operation noise levels range from 80 to 100dBA at 50 feet. Combining the background noise levels with the project-related noise levels results in a cumulative noise impact of 80 to 100dBA at 50 feet.

The project-related noise levels attenuate to within background noise levels within approximately 1.8 miles from the noise source. Local topography would further reduce this zone of audibility. It is unlikely that noises generated by activities from other projects would combine with noises generated at the mine site. Potential cumulative impacts do exist, however, along the access roads, where noises generated from vehicle traffic associated with other projects could combine with noises associated with East Boulder Mine Project vehicular traffic.

## 4.16 ENVIRONMENTAL IMPACTS BY ALTERNATIVE

The following sections provide a summary of the potential environmental, social, and/or cultural impacts which may be anticipated for implementation of each alternative. For detailed explanation of the various impacts the reader is referred to the impacts analysis provided in Sections 4.1 through 4.15 of this chapter.

### 4.16.1 Impacts Summary: Alternative 1 - No Action

This alternative represents baseline conditions which assume full implementation of the approved exploration project. The following impacts could potentially occur:

- Minor increases in sediment loading to the East Boulder River which should not adversely impact aquatic ecology or the current streambed course may occur.
- Alteration of groundwater flow patterns and possible changes in groundwater availability in limited areas due to the intersection and dewatering of fissures during exploration activities may occur.
- Slight decreases in long-term soil productivity and slightly less vegetative growth.
- Soil erosion near stream crossings, particularly during construction of new bridges or shoring of existing structures. Some unidentified impacts to riparian communities will occur (per the Jackpine FONSI).
- Loss of deer habitat due to increased road traffic.
- Fishing demand on the East Boulder River will likely increase at first due to additional worker influx, but be reduced after fishing pressure increases to a point where access is crowded and/or resources are depleted.
- Approximately 30 acres will be removed from the timber base.
- Weed infestation may occur in disturbed areas.
- Some habitat containing the yellow springbeauty, a species of special concern, will be lost.
- Some degradation of existing air quality will occur due to increases in particulate and gaseous emissions.
- Increased traffic and environmental impacts could alter land use habits of the full- and part-time residents in the East Boulder River Valley.
- Short-term visual impacts associated with mine exploration are localized mostly to the foreground distance zone. Some contrasts associated with landscape modification will occur.
- The recreational experience of the area will be changed from a semi-primitive setting to one less isolated.

- Increased poaching of wildlife may occur, and hunting in the East Boulder River Valley will likely be adversely affected.

- Use of Roadless Area 1371 and the Absaroka-Beartooth Wilderness is likely to occur.

- Increased noise levels will result from mine tunneling and construction activities associated with exploration.

**4.16.2 Impacts Summary: Alternative 2 - Proposed Action**

This alternative consists of SPGMR's proposed project including the construction, operation and closure and reclamation of mine, mill, and ancillary facilities located in three permit areas; the upgrading of an existing access road system; and the upgrading of the existing electrical power line and additional power line construction to the mine site. The following impacts could potentially occur:

- Physical and/or visual alteration of cultural resource properties may occur.

- Intentional collection and destruction of cultural material may occur as an indirect result of increased recreational activity.

- Unintentional disturbance of unstable land forms which contain buried cultural resources as a result of increased recreational activity may occur.

- Temporary increases in runoff and erosion during facilities construction periods could result in a 5 percent to 7 percent increase in sediments carried by the East Boulder River, but adverse impacts to downstream beneficial uses or channel patterns are not anticipated.

- Spills or leaks of chemicals and fuels could impact groundwater and the East Boulder River, depending on the chemical potency, amount of material spilled/leaked, and mitigation measures.

- The septic system could introduce contaminants such as ammonia, nutrients and coliform bacteria into the groundwater and East Boulder River. This impact would result in degradation of existing water quality.

- Increased flows in the East Boulder River could result from percolation pond water infiltration migration to the river; flow increases could range from 0.5 percent to 25 percent.

- Percolation ponds would add additional nitrates and possibly other compounds to the groundwater which may over time migrate to the East Boulder River. This impact would result in degradation of the existing water quality.

- Percolation ponds could clog over time, and mitigation measures would be required to prevent overflow.

- Detrimental flow reduction in the East Boulder River could occur between the permitted surface water withdrawal point and the area of river water recharge from the percolation ponds.

- Some additional sediment loading to the East Boulder River could occur during facilities removal associated with mine closure.

- Introduction of nitrates and other contaminants into the groundwater may occur via a leaking or overflowing tailing impoundment, or through the percolation ponds. This impact would result in degradation of existing water quality.

- Slight decrease in long-term soil productivity, causing slightly less productive vegetative growth will occur.

- Alteration of the project area topography resulting in a more graded appearance, marked by a plateau-like area (tailing impoundment) with steep downstream slopes.

- Slight surface subsidence could occur in some areas, as well as increased bedrock fracturing. This could cause increased surface water capture and increased mine water discharge.

- Surface water infiltration upgradient of the tailing impoundment could create conditions for liquefaction and thereby reduce tailing impoundment stability.

- Loss of approximately 233 acres of vegetation and wildlife habitat.

- Potential for lowered wildlife use due to increased noise and human activity.

- Temporary displacement of elk from small portions of summer/fall use habitat areas on the East Boulder Plateau.

- Up to 10 acres of mule deer wintering habitat may be lost.

- There would be an increased potential for vehicle collisions (and increased roadkill mortality) with deer and other species due to increased vehicular traffic.

- Some displacement of local deer away from traffic areas, resulting in some indirect loss of summer and winter habitat.

- Minor loss of white-tailed deer year-round habitat in areas of SG 31 upgrade.

- Some displacement of moose during construction activities, and minor alterations of moose habitat in the Placer Basin permit area.

- Loss of black bear habitat in the East Boulder permit area and an increased potential for human/black bear interactions.

- Minor habitat loss for other species, including raptors, upland game, and mountain lion.

- Increased potential for vehicle/bald eagle collisions and roadkill.

- Localized minor impacts upon brown trout and rainbow spawning areas could result from sediment increases near bridge upgrades.

- Withdrawal of surface water during low flow periods could adversely impact fisheries. Operation of the surface water diversion could result in minor losses of fish and/or other aquatic organisms.

- The increased groundwater discharge to the East Boulder River, resulting from mine water discharge percolation, could be beneficial to aquatic resources especially during otherwise low flow periods.

- Detrimental impacts on aquatic resources would result from catastrophic failure of the tailing dam and subsequent sediment releases to the East Boulder River.

- The Main Boulder and Yellowstone Rivers would likely see increased fishing pressure, with much of the increase concentrated on publicly accessible fishing areas.

- Increased fishing pressure on the East Boulder River could adversely impact local fish populations.

- Yellow springbeauty plants located within the East Boulder permit area would likely be destroyed by construction/devegetation activities.

- Disturbed sites would be susceptible to noxious weed invasion.

- Approximately 200 acres would be removed from timber production.

- Revegetation of the tailing dam would be difficult considering the steep slope.

- Air quality would be degraded over existing environment due to increases in particulate and gaseous emissions.

- Increased traffic would occur on SG 31 and FAS 298, creating a reduction in road safety and efficiency. More accidents, accidents with injuries, and accidents with fatalities would occur.

- Improvement of SG 31 and its use as a mine access road would create increases in dust and noise levels to East Boulder River Valley residents.

- Alterations of land use patterns by full- and part-time residents of the East Boulder River Valley could occur due to increased traffic, noise, etc.

- Some change in timber production management plans would occur due to deforestation of the permit area. Nonproductive timber management activities would occur for the life of the project in the permitted area.

- Land use patterns in nearby communities (Big Timber, Livingston) and rural areas near the permit area (Main Boulder River Valley) may change due to increased residential and commercial development.

- Localized visual impacts would occur due to facilities construction and vegetation removal, and the placement of sharply contrasting elements of natural and mine-affected features.

- Construction of the tailing impoundment would create a dominant geometric landform drawing considerable visual attention. Partial retention VQO in the Forest Plan would not be met.

- Moderate and short-term visual impacts would be caused by reconstruction activities along the Main and East Boulder Rivers, and by activities associated with powerline upgrading along FAS 298 and along SG 31.

- Recreational and wilderness impacts would be similar to those described in Alternative 1, but would be expected to continue for the long-term operation of the mine.

- Big game species distribution may be altered and less common in the immediate area of the project site. A private outfitter's camp at the Dry Fork headwaters could be affected such that the semi-primitive experience would be reduced.

- The Absaroka-Beartooth Wilderness could be impacted infrequently by noise generated from construction activities, and the opportunities for solitude inherent in wilderness experience reduced.

- Recreational opportunities would be changed. For instance, the scenic driving experience would be reduced due to increased traffic on area roads. Area campgrounds would be at capacity more often, and recreational facilities in Big Timber in particular would receive much heavier use.

- Hunting pressure would likely increase, especially in areas near accessible roads and trails. This could result in a lower hunter success rate if pressure reaches the point that game are displaced. Also, the numbers of game animals could be reduced due to increased harvest.

- Noise impacts are expected from mining and milling activities, mine and mill support vehicles, and commuter and access road traffic.

- Noise generated by adit ventilation fans in the Placer Basin permit area may be audible in the Absaroka-Beartooth Wilderness.

- Population migration into Sweet Grass County would peak by Year 6 of the project at an estimated 1,196, an increase of 38 percent over the estimated 1990 county population. Eighty percent of the immigrant population would live in Big Timber, 20 percent in rural areas of the county.

- The project would generate a minimum estimated $24.5 million in annual direct and indirect income during operations.

- In-migrating populations would generate demand for additional community services, particularly in general government and administration, law enforcement, road maintenance, water and sewer system capacity, educational opportunity, fire protection, and hospital services.

- The City of Big Timber would incur capital costs and higher operating costs to provide additional community services, while Sweet Grass County would incur higher capital and operating costs to provide a higher level of law enforcement service.

- Additional monies would be available to the area educational programs through an increased tax base and higher state foundation program payments.

- Changing socioeconomic conditions may create some dissatisfaction among residents of the area impacted by the mine project and recreational users of the GNF.

#### 4.16.3 Impacts Summary: Alternative 3 - Modified Tailing Impoundment Configuration

Under this alternative a reconfigured tailing impoundment design is incorporated which has an outer embankment slope of 2(H):1(V) versus the proposed impoundment design slope of 1.6(H):1(V). Most impacts are likely to be as described for Alternative 2. Only new, reduced or increased impacts specifically associated with the tailing impoundment are mentioned here. The following impacts associated with this alternative are:

- Potential concerns over impoundment failure are similar to those for Alternative 2, although the modified impoundment configuration has a greater dam stability and outer slope stability (relative to slumping).

- Impacts to aquatic resources for the modified tailing impoundment are anticipated to be the same as for Alternative 2, although the likelihood of catastrophic impact on the river may be slightly reduced.

- Modification of a more gentle slope to the tailing impoundment would cause a slight reduction in the line element of the visual contrast to the landform; however, high visual impacts would remain. The potential for easier reclamation of the impoundment slope and use of timber in revegetation could reduce the long-term visual impacts of the impoundment.

- A reduction in the amount of tailing storage could conceivably correspond to a reduction in the amount of minable ore, thereby accelerating project closure. The socioeconomic impacts of project closure would therefore also be moved forward in time.

#### 4.16.4 Impacts Summary: Alternative 4 - Alternative Access Road/Power Line Alignments

This alternative considers two alternative road/power line alignments to the proposed upgrade of the existing county road. The following impacts associated with the road/power alignments are:

- Cultural resource impacts could be similar to those described for Alternative 2.

- Some increased soils erosion and subsequent long-term sedimentation to the East Boulder River could occur since the routes would cross irrigated farm land.

- Stream crossings would be increased relative to the proposed road route, resulting in an overall increase in soil erosion from short-term, construction activities.

- Construction of an additional bridge crossing for the Bench/Valley Route (as opposed to the Bench Route) would result in short-term sedimentation increases to the East Boulder River. Also, the bridge could change the river morphology (shape) downstream.

- Bench and Bench/Valley Routes have high potential for slumping due to present design siting above an active landslide and below an irrigation ditch. In many areas the routes are above a steep slope and below wetland areas which could saturate soils and contribute to slumping or landslides.

- Potential impacts to aquatic resources are significantly reduced for either alternative road route because of the lower potential for sedimentation of the East Boulder River during upgrades.

- Both alternative road routes would disturb cropland, rangeland, pasture, and meadow, as well as intersecting a series of wetlands.

- Disturbance areas along roads and powerlines would be especially prone to weed invasion.

- Temporary air quality degradation would result from construction activities associated with new road installation for both alternative routes.

- Alterations in land use of agricultural areas could occur due to either alternative road placement. These may include irrigation interference or loss of productive acreage.

- Both the Bench and Bench/Valley routes would draw visual attention and cause short-term high visual contrast during construction. Lesser visual impact would be caused during operations.

- Some increased noise would be expected from construction of either new access route.

- Both the Bench and Bench/Valley routes are thought to be less undesirable to East Boulder Valley residents than use of the existing route.

### 4.16.5 Impacts Summary: Alternative 5 - Power Supply Corridor Systems

This alternative considers two alternative electrical power corridor systems to bring power from the existing Montana Power 161-kV line to the Duck Creek substation. Potential impacts include:

- Impacts to cultural resources cannot be predicted because of a lack of information regarding the area which could be impacted.

- Impacts to surface water resources could include minor increased sedimentation.

- Increased soil erosion and soil compaction could occur from power line construction, regardless of route selected.

- Disturbance of terrestrial wildlife during construction, and some minor losses of habitat may occur in grasslands and hay meadows. Also, a permanent loss of about one-quarter acre of wildlife habitat due to construction/operation of the substation would result.

- Impacts on aquatic resources due to powerline construction activities could easily be minimized by the use of appropriate erosion control procedures.

- Disturbance areas along powerline routes and access roads would be especially prone to weed invasion.

- Rangeland communities and productive agricultural lands would be disturbed only temporarily by powerline construction.

- Temporary air quality impacts would result from land clearing and construction of power corridors, and through particulate emissions and gaseous emissions from vehicles and construction equipment.

- Construction and operation of powerlines for either route considered could interfere with irrigation procedures on agricultural lands.

- Visual resources would be impacted by either powerline alternative by drawing attention from the Yellowstone River Valley.

- Noise levels would increase during powerline construction activities, and are expected to be audible up to 1.8 miles away from the activity. Some minimal noise may be associated near the 69 Kv electrical power transmission lines, especially in wet weather.

#### 4.16.6 Impacts Summary: Alternative 6 - Water Treatment Alternatives

This alternative considers various methods to eliminate or reduce the magnitude of surface water and groundwater degradation resulting from septic system operations, mine waste water discharge, and tailing impoundment leaks and seeps. Impacts of this alternative include:

- Implementation of one of the three water treatment alternatives would likely result in the prevention or reduction of nitrate and other contaminant compound levels in mine wastewaters prior to disposal in the percolation ponds, and therefore, a reduction of contaminant levels in the groundwater and East Boulder River in comparison to Alternative 2.

- Solid wastes may be generated by wastewater treatment which would require approved disposal on or off site depending on the solid wastes' characteristics.

- Additional electrical power requirements would have to be met should treatment be required and should power be necessary.

- Treatment of mine wastewater would maintain existing aquatic habitat or improve habitat over conditions under Alternative 2.

- Construction and operations of wastewater treatment facilities would add minimally to the traffic for the life of the mine and would result in continued periodic traffic to the mine site for the life of the water treatment program.

- Additional facilities and their continued operation beyond the life of mine could add to and extend the duration of visual and noise impacts.

### 4.16.7 Impacts Summary: Alternative 7 - Proposed Action with Modifications

SPGMR's proposal is modified under this alternative by the incorporation of several measures and requirements designed to mitigate environmental impacts. The potential remaining impacts may include:

- There is some possibility for tailing dam failure due to a larger-than-anticipated earthquake.

- Slight decrease in soil productivity causing slightly less productive vegetative growth would occur.

- Potential concerns over impoundment failure are similar to those described for Alternative 2 and 3, although the mitigation measures described in Section 2.5 would identify the potential for materials liquefaction and instigate alternative water disposal techniques.

- Impacts to wildlife are similar as those described for Alternative 2, except for impacts mitigated by the measures described in Section 2.5.

- Temporary air quality impacts resulting from road construction and powerline development would be similar to those noted for Alternatives 2, 4 and 5.

- Mitigation measures stipulated in this alternative would reduce many of the impacts associated with increased road traffic. Nevertheless, some increase in noise, dust, safety hazards, and other problems would result as described in Alternatives 2 and 4.

- Land use impacts for this alternative would be the same as described for Alternative 2.

### 4.16.8 Impacts Summary: Alternative 8 - Twin Production Adits

Alternative 8 is very similar in scope to Alternative 7, except that Alternative 8 incorporates the use of twin production adits to reach the ore zone, rather than the single adit described in the proposed action. This modification would eliminate the need for a breakout at Brownlee Creek. Alternative 8 would exhibit the same impacts as Alternative 7, with the following exceptions:

- Surface water impacts would be reduced relative to Alternative 7 because of the elimination of the Brownlee Creek breakout, and it is predicted that less mine water would be discharged.

- A relatively small increase in waste rock would occur under Alternative 8 because of the additional material generated by driving two parallel tunnels. This may require a slight increase in reclamation requirements; however, the soil disturbance at Brownlee Creek would be eliminated.

- The potential for impacts at Brownlee Creek would be eliminated for the following resources: cultural, waste rock/reclamation, wildlife, aquatic life, habitat, vegetation and wetlands, air, noise, recreation, and visuals.

### 4.16.9 Impacts Summary: Cumulative Impacts

Projects of concern were briefly discussed in Section 2.6 which have the potential for causing additional environmental impacts over and above those attributable to the East Boulder Mine project. When considered in conjunction with the East Boulder Mine impacts the cumulative environmental impact upon a resource may decrease or, in most cases, increase. Potential cumulative impacts include:

- Increased sedimentation would occur in the East Boulder River due to mine exploration, construction, and closure and reclamation activities and the effects of the East Boulder Timber Sale.
- Increased mineral exploration in the Stillwater Complex increases the likelihood of further extraction of minerals, including those considered strategically important. The Stillwater Integrated Resource Analysis is addressing the potential cumulative impacts of increased mining activity on mineral resources and other environmental concerns such as wildlife habitat, vegetation, timber, aquatic resources, etc.
- Aspen stand regeneration projects and other habitat enhancement activities would have a beneficial impact on elk and other species.
- Timber harvest projects may have positive and negative impacts on elk and other big-game species.
- Beaver reintroduction projects into the Main, East and/or West Boulder Rivers would positively impact fisheries by increasing habitat diversity and maintaining pools, although fish passage may be hindered.
- Other, related development activities may bring more people and associated recreational use into the area, thereby increasing fishing pressure in the East Boulder and other fisheries.
- Increased vehicular traffic from other projects in the area could increase overall impacts on regional air quality, although exceedances of state or federal standards are unlikely.
- Increased vehicular traffic from other projects could cause additional road maintenance needs and safety hazards, and increase noise levels.
- The proposed Wright-Gulch timber sale may cause localized visual impacts primarily in the foreground distance zone.
- Noise associated with the East Boulder Project and other related development activities can cause greater impacts on the Absaroka-Beartooth Wilderness experience.
- Increased road access due to related development activities would provide additional opportunities for recreation, although this may also cause increases in wildlife poaching and illegal ORV use.

## 4.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development, operation, and closure and reclamation of an underground platinum/palladium mine, surface mill, tailing disposal impoundment and other associated facilities in the East Boulder River Valley would involve irreversible and irretrievable commitments of various resources that are either consumed, committed or lost during the life of the project and beyond. Nonrenewable resources such as minerals are an irreversible commitment if used. An irretrievable commitment refers to resources, resource production or the use of a renewable resource that is lost because of land allocations or a scheduling or management decision. Methods to protect natural resources that could be irreversibly affected by management practices are incorporated into mitigation measures where possible.

Irreversible commitments of resources include:

- Platinum and other minerals removed from the mine are nonrenewable resources and would constitute an irreversible commitment.
- Although proposed mitigations would reduce the possibility of impacting cultural resources, a site could be inadvertently altered or destroyed and therefore irreversibly lost.
- Road-building would irreversibly alter the natural landscape, although reclamation could return the landscape to pre-mining appearances. Road development would also cause an irreversible loss of soils due to accelerated erosion.
- Construction of the tailing impoundment would irreversibly alter the natural landscape and possibly the visual qualities of the East Boulder permit area.
- Road and bridge development and upgrading could alter the morphology (shape and character) of the East Boulder River.
- Subsidence in some mined areas could occur, irreversibly altering the surface topography and changing surface water and groundwater flow patterns.
- Installation of new power transmission poles and lines would alter the visual characteristics of the landscape north of the Yellowstone River and remove a very small amount of land from agricultural and/or grazing use. This is considered to be an irreversible commitment of resources because the transmission facilities would likely not be removed after the mine has closed.

Irretrievable commitments of resources include:

- Wildlife may be displaced due to habitat loss, noise, and other impacts during mine construction and operation, resulting in a loss of big-game hunting opportunities. Reclamation should return wildlife habitat to pre-mining conditions.
- Natural vegetative cover, including timber resources, would be an irretrievable loss for the duration of the mine project. Pre-mining vegetative character may not be achieved through reclamation because of other natural forces such as fire and natural succession.

- Soil development and productivity would be irretrievably lost in the permit areas due to facilities construction and altered land use.

- An irretrievable commitment of air resources would occur due to the additional emissions resulting from mine construction, operation, and reclamation.

- Persons directly impacted by transportation routes (i.e., those persons residing in the East Boulder Valley if SG 31 is used) would experience an irretrievable loss of rural lifestyle due to increased traffic, noise, and degradation of air quality.

- An irretrievable degradation of groundwater and surface water resources could occur under most alternatives which would not, however, present unacceptable impacts due to the low concentrations of compounds which could enter the systems.

## 4.18 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM RESOURCE PRODUCTIVITY

Short- and long-term impacts of implementation of the various alternatives were assessed in Sections 4.1 through 4.15. This section addresses the impacts on long-term productivity of resources after the mine project has closed and undergone reclamation.

- Some lands would be removed from timber production for the life of the mine project. However, post-mining reclamation should restore these areas to productive timber lands.

- New road development would reduce agricultural productivity in some areas (i.e., Bench or Bench/ Valley routes). They also reduce wildlife habitat to some extent, although they can increase recreational opportunity as well. If the road(s) is not reclaimed and remains as an access route after mine closure, these alterations would remain as permanent impacts on long-term resource productivity.

- The extraction of platinum and other strategic minerals during mine operation would enhance national energy independence and national security.

- Facilities construction and roads development could have long-term impacts to soils productivity through soils compaction, erosion, and nutrient loss. Impacts to soils productivity could result in additional long-term impacts to vegetation, wildlife habitat, and visual character of the permit areas.

The alternatives evaluated in this EIS were developed in response to issues identified during the scoping process (See Subsection 2.1). These alternatives were subjected to an analysis of direct, indirect, and cumulative impacts in Chapter Four. This chapter provides a comparative analysis of the impacts on environmental resources resulting from implementation of the alternatives, including the No Action and Proposed Action alternatives.

Many impacts would be mitigated by the implementation of measures (Alternative 7) which would eliminate or reduce the level of impact. Residual impacts remaining, even with mitigation measures applied, are unavoidable adverse impacts. Resource specific impacts are compared by alternatives in Table 5-1, and briefly discussed below.

## 5.1 CULTURAL RESOURCES

Eleven prehistoric cultural resource properties are located in or near two of the three proposed permit areas. Implementation of Alternative 1 should have no impact on these resources. Implementation of Alternatives 2 and 3 would potentially impact some or all of the sites, either through direct alteration of the properties and/or indirect or unintentional disturbance. Implementation of Alternatives 4A and 4B could directly and indirectly impact an extensive prehistoric site complex, and possibly other cultural resource properties as yet unidentified. Implementation of either variation of Alternative 5 could impact cultural resources, if present, in the affected areas. However, routes for the potential powerline corridors have not been investigated and the extent of potential impact is unknown. Implementation of an Alternative 6 wastewater treatment process would have no additional impacts on cultural resources beyond those impacts for Alternative 2. Implementation of Alternative 7 would result in the same impacts as Alternative 2, except for those impacts mitigated by the measures described in Section 2.5. Implementation of this alternative would require that a cultural resource survey be conducted prior to DSL and GNF approval of breakouts on the East Boulder Plateau to reduce or eliminate possible impacts to cultural resources as deemed necessary by the agencies. Alternative 8 would eliminate the potential for impacts to cultural resources in the Brownlee Creek permit area.

## 5.2 SURFACE WATER RESOURCES

Potential impacts caused by the implementation of Alternatives 1, 2, and 3 include sediment runoff and sediment addition to streams, and stream water quality degradation from turbidity and nutrients or chemical loading. Impacts to surface waters from Alternative 1 would be of much shorter-term than for Alternatives 2 and 3. Impacts caused by Alternatives 2 and 3 could be much greater than for Alternative 1, since a catastrophic sediment release from the tailing impoundment could not occur under the No-Action (Alternative 1) scenario.

A summary for Alternative 2 expected water quality impacts under low and average flow conditions is presented in Table 5.2-1.

Impacts to surface waters resulting from implementation of Alternatives 4A and 4B are similar: increased sediment loading during construction activities, and runoff from increased erosion potential. Another short-term impact is a possible spill or release of materials being transported to the site. Alternative 4B requires development of an additional bridge crossing, which could potentially change river morphology downstream.

TABLE 5-1

SUMMARY OF EFFECTS FOR THE EAST BOULDER MINE PROJECT ALTERNATIVES

| Source/Type of Disturbance | ALT 1 | ALT 2 | ALT 3 | ALT 4 | | ALT 5 | | ALT 6 | ALT 7 | ALT 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 4A | 4B | 5A | 5B | | | |
| Mine Development | No | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| New Roads (miles) | 1.0 | 2.6 | 2.6 | 9.1[a] | 9.6[a] | 4.0[a] | 3.5[a] | 2.6 | 2.6 | 2.6 |
| Road Upgrade (miles) | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| Acres of Road Affected | 96.2[b] | 114[b] | 114[b] | 138[b] | 140[b] | 128[b] | 126[b] | 114[b] | 114[b] | 114[b] |
| permit area Disturbance (acres) | 30 | 233 | 233 | 233 | 233 | 233 | 233 | 233 | 233 | 230 |
| Tailing Pond (acres) | <1 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 | 105 |
| Tailing Dam Slope | N/A | 1.6:1 | 2:1 | 1.6:1 | 1.6:1 | 1.6:1 | 1.6:1 | 1.6:1 | 2:1 | 2:1 |
| Miles Powerline | 0 | 12-15 | 12-15 | 12-15 | 12-15 | 26-29[c] | 25-28[c] | 12-15 | 12-15 | 12-15 |
| Miles New Power Corridor | 0 | 2.6 | 2.6 | 2.6 | 2.6 | 5.7 | 4.5 | 2.6 | 2.6 | 2.6 |
| No. of Stream Crossings (w/upgrades) | 7 | 7 | 7 | 7 | 8 | 7 | 7 | 7 | 7 | 7 |
| Wildlife Habitat (acres) | 126.2[b] | 347[b] | 347[b] | 371[b] | 373[b] | 361[b] | 359[b] | 347[b] | 347[b] | 343[b] |
| Total Particulate Emissions (tpy)[d] | 15 | 95.13 | 95.13 | 3.55 | 3.55 | -- | -- | 95.13 | NE[f] | NE |
| Respirable Particulate (PM-10) Emissions (tpy)[d] | 8.43 | 72.25 | 72.25 | NE | NE | -- | -- | 72.25 | NE[f] | NE |
| Hydrocarbon Emissions (tpy)[d] | 72.99 | 72.99 | 72.99 | NE | NE | -- | -- | 72.99 | 72.99 | NE |
| Carbon Monoxide (tpy)[d] | 32.96 | 32.96 | 32.93 | NE | NE | -- | -- | 32.96 | 32.96 | NE |
| Nitrogen Oxide (tpy)[d] | 47.09 | 47.09 | 47.09 | NE | NE | -- | -- | 47.09 | 47.09 | NE |
| Maximum Annual PM-10 Emissions ($\mu g/m^3$) | 5.1 | 25.87 | 25.87 | NE | NE | -- | -- | 25.87 | 5.1 | NE |
| 24-hour PM-10 Emissions ($\mu g/m^3$) | 7.4 | 34.6 | 34.6 | NE | NE | -- | -- | 34.6 | 34.6 | NE |
| Oxides of Nitrogen ($\mu g/m^3$)[e] | 13.7 | 13.7 | 13.7 | NE | NE | -- | -- | 13.7 | 13.7 | NE |
| Sediment Loading to East Boulder River (tons per 5 years) | 28 | 183 | 183 | NE | NE | -- | -- | 183 | NE[g] | <183 |

[a] Includes 2.6 miles of new road in forest
[b] Assume road and power corridor are 30 ft. wide
[c] Includes 12-15 miles McLeod to mine site
[d] Tons per year
[e] Micrograms per cubic meter
[f] Due to mitigation measures, particular emissions will be reduced, but an exact figure is unavailable.
[f] Due to mitigation measures, sediment loading to the East Boulder River will be reduced, but an exact figure is unavailable

NE Not evaluated
N/A Not applicable

TABLE 5.2-1

PREDICTED EAST BOULDER RIVER WATER QUALITY CONCENTRATIONS FOR PARAMETERS IN SPGMR PETITION (mg/l)

| Parameter | Average Ambient Surface Water Concentrations | Low Flow Alternative 2 | Low Flow Alternative 6a | Low Flow Alternative 6b | Low Flow Alternative 6c | Average Flow Alternative 2 | Average Flow Alternative 6a | Average Flow Alternative 6b | Average Flow Alternative 6c | Surface Water Quality Criteria |
|---|---|---|---|---|---|---|---|---|---|---|
| Total Dissolved Solids | 100 | 122 | * | 120 | 122 | 102 | * | * | * | 250 |
| Nitrite & Nitrate | 0.092 | 2.4 | 0.1 | 0.1 | 2.4 | 0.3 | 0.1 | 0.1 | 0.3 | 10 |
| Ammonia | <0.1 | <0.6 | * | <0.1 | <0.2 | <0.2 | * | * | <0.2 | |
| Iron | <0.053 | * | * | * | * | * | * | * | * | 0.3 |
| Manganese | <0.012 | <0.014 | * | * | * | * | * | * | * | 0.05 |

*Resulting surface water concentration would be less than ambient.

The existing road route (part of Alternative 2) is likely to have more direct environmental impacts than Alternatives 4A or 4B, due to closer proximity to the river, steeper traverses, and sharper curves.

Based on available information for surface waters near or to be crossed by Alternatives 5A and 5B, the impacts (minor increased sedimentation, potential changes in stream morphology, and potential changes in the stability of power line structures) would be similar for the two powerline alternatives.

Implementation of an Alternative 6 wastewater treatment process would likely reduce levels of contaminant compounds such as nitrates, certain metals, and total suspended solids, thereby avoiding or reducing impacts to stream water quality. Implementation of Alternative 7 would result in similar impacts as Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures described in Section 2.5. Impacts to be mitigated under this alternative include the possibility of low quality water entering the East Boulder River during operation and after closure; surface water runoff entering the tailing impoundment; the possibility of surface flow in the East Boulder River disappearing; additional sediment loading on the East Boulder River from using soil only for reclamation of the tailing impoundment and dam outslope, and from road construction and usage; the possibility of chemical and petroleum-based spills in the East Boulder River; the possibility of rocks with acid-forming potential being introduced unknowingly into the area; and the possibility of tailing impoundment failure.

Alternative 8 should reduce impacts to surface water relative to Alternative 7 because the Brownlee Creek adit would not be required for this alternative. The potential for degradation of surface water from the Brownlee Creek adit source or facilities construction would be eliminated. Other impacts would be similar to Alternative 7.

## 5.3 GROUNDWATER

Impacts to groundwater from Alternatives 1, 2, and 3 could occur due to tunnel blasting, construction needs, mine water handling, and other activities. Alternative 1 impacts are expected to be short-term, occurring only during the duration of mine exploration. Impacts resulting from implementation of Alternatives 2 and 3 would be long-term, and could be of greater magnitude, since problems could be created by improper disposal of process waters, leakage from the tailing impoundment, and spills from chemical transport. Also, groundwater could be impacted by the sewage disposal unit. Alternatives 2 and 3 impacts are considered the same.

Alternatives 4A and 4B, and 5A and 5B, are expected to have no impacts on groundwater.

Implementation of an Alternative 6 wastewater treatment process would likely reduce levels of contaminant compounds, thereby avoiding or reducing impacts to groundwater quality. Implementation of Alternative 7 is expected to have similar impacts as the implementation of Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures described in Section 2.5. Impacts to be mitigated include possible groundwater contamination due to the percolation ponds and septic system, and the possible threat to the stability of the tailing dam due to groundwater levels.

As with surface waters, the reduction in mine water flow anticipated for Alternative 8 should reduce the overall impact on area groundwater.

## 5.4 SOILS

Soils impacts are typically short-term and minor, assuming appropriate construction and reclamation techniques are employed. The amount of soil impact is directly related to the amount of area disturbed. Alternative 1 will result in the disturbance of much less area relative to Alternatives 2 and 3. The amount of soil disturbed in Alternatives 2 and 3 could result in a long-term decrease in soil productivity. Temporary impacts for Alternatives 1, 2, and 3 will result from mine construction activity; this will also be when most of the erosion and sedimentation takes place. Relative impacts for Alternatives 2 and 3 should be similar.

Additional soil would be exposed to short-term erosion in Alternatives 4A and 4B because of new road development. Alternatives 4A and 4B could cause direct, short-term impacts due to soil slumping or landslides if appropriate drainage engineering and slope shoring is not employed during construction. Direct impacts are expected to be slightly greater for Alternative 4B than for 4A since 4B would cross streams 8 times as opposed to 7 times for Alternative 4A, and would require 7 miles of new road as opposed to 6.5 miles for Alternative 4A.

Construction of either Alternative 5A or 5B power supply system would increase potential for soil erosion and soil compaction.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Alternative 7 is expected to have similar impacts as Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures described in Section 2.5. Impacts to be mitigated under this alternative include soil loss due to erosion and sedimentation on the tailing impoundment surface; soil compaction, rutting, and erosion from construction of un-improved roads during wet periods; and the availability of suitable soil materials for reclamation.

Soil disturbance for Alternative 8 would be reduced since no disturbance and reclamation would be required at the Brownlee Creek adit site. However, a slight amount of additional waste rock would be produced under Alternative 8 and this may require a slight increase in reclamation requirements.

## 5.5 GEOLOGY AND GEOTECHNICAL CONDITIONS

Alternatives 1, 2, and 3 would alter the existing permit area near the proposed East Boulder adit through leveling and grading, although Alternative 1 would have shorter-term and less impact than 2 or 3. A significant difference between Alternatives 2 and 3 and the No Action Alternative (Alternative 1) is the construction and use of a tailing impoundment, resulting in the disturbance of an additional 105 acres. Failure of the tailing impoundment could have major downstream short-term, and unknown long-term, impacts due to the release of stored waste sediments. Alternatives 2 and 3 would result in long-term depletion of some mineral resources from the Stillwater Complex. Because of the slightly reduced capacity of Alternative 3's tailing impoundment, it would result in incrementally less minerals mined and waste material stored or released during failure.

Some disturbance would occur on the East Boulder Plateau due to the development of air shafts and escapeways for Alternatives 2 and 3, but the likelihood of subsidence or measurable geologic impact is low.

Implementation of road Alternatives 4A or 4B would encounter similar geologic conditions, and impacts are therefore similar in magnitude. They would probably be considered to have greater impact on the valley geology/topography than the existing road route (Alternative 2) because of the new construction required. Some long-term alteration of surface and groundwater drainage patterns could occur under Alternatives 4A or 4B to ensure that road failure due to slumping or slides does not occur.

Alternatives 5A and 5B are not predicted to have measurable impacts on the geology or topography of their respective powerline routes.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Alternative 7 has similar impacts as Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures as described in Section 2.5. Impacts to be mitigated under this alternative include long-term stability of the tailing impoundment and the impoundment outslope, and the possibility of dam failure.

No disturbance of the topography would occur in the Brownlee Creek adit area under Alternative 8. The potential for mine-related subsidence in this area would also be eliminated. Design of the twin production adits would account for wall competence and earthquake potential to minimize the potential for failure between the two tunnels. A slight increase in waste rock production (approximately 28,000 $yd^3$) would occur if Alternative 8 were implemented.

## 5.6 WILDLIFE

Direct wildlife habitat loss will occur under implementation of Alternatives 1, 2, and 3, but the magnitude of loss varies. Under the No Action Alternative (Alternative 1) approximately 30 acres of mule deer habitat will be lost, while approximately 233 acres would be lost under Alternatives 2 and 3. Increased animal mortality would result indirectly from road kill and improved hunter access for all alternatives. In addition, implementation of Alternatives 2 and 3 would result in disturbance to other wildlife species, including black bear, moose, elk, white-tail deer, and non-game species. Alternative 3 could result in lesser long-term impacts due to improved revegetation and earlier habitat restoration following closure.

Road Alternatives 4A and 4B would result in fewer wildlife impacts than the proposed action (Alternative 2) due to a reduction in road kills and avoidance of some riparian habitat. Powerline Alternatives 5A and 5B would cause some short-term disturbance to wildlife during construction, and likely short-term impacts on grassland and agricultural habitat.

The loss of habitat in Alternatives 1, 2, and 3 would all result in negative short- and long-term cumulative impacts to wildlife in the Stillwater Complex, although habitat restoration would be expected to occur at the end of mine life. Cumulative impacts from Alternatives 2 and 3 are similar, and greater than for Alternative 1.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Alternative 7 would have similar impacts as Alternative 2; however, the application mitigation measures as described in Section 2.5 would reduce or eliminate some impacts to wildlife. Impacts to be mitigated include possible road kills, impacts during critical times, impacts to

threatened and endangered species, and wildlife intrusions into the tailing impoundment area. Alternative 8 would eliminate the potential for impacts to wildlife in the vicinity of the Brownlee Creek adit.

## 5.7 AQUATIC BIOLOGY

Increased sedimentation would occur in the East Boulder River due to implementation of Alternatives 1, 2, and 3. However, the direct impacts on the aquatic community from Alternative 1 will be minor since only 28 tons of sediment are predicted to be introduced over 5 years. Some indirect effects on aquatic fisheries will likely occur under Alternative 1 because of increased recreational use.

Alternatives 2 and 3 would impact aquatic habitats due to sediment loading, changes in water quality, changes in fish passage, and changes in fishing pressure. These impacts, detailed in Subsection 4.7.2, are expected to be essentially equal for the two alternatives.

Implementation of Alternatives 4A and 4B would reduce some impacts on the East Boulder River, compared to the proposed road route (Alternative 2) because of the relocation of approximately 4 to 5 miles of corridor away from riparian areas. This would also reduce the potential for spills to impact surface waters. However, greater potential for short-term impacts lies with Alternatives 4A and 4B relative to Alternative 2, because of the increased construction activity and bridge development. Impacts from Alternative 4B are likely to be slightly greater than for Alternative 4A.

Impacts on surface waters would occur during implementation of Alternatives 5A or 5B. Intermittent or minor streams occur in the proposed powerline paths; however, impacts on aquatic communities would likely be minor or non-detectable, depending on installation techniques.

Implementation of an Alternative 6 wastewater treatment process would reduce degradation of stream water quality and reduce contaminant compound levels in the East Boulder River relative to the proposed action. Implementation of Alternative 7 would have similar impacts as Alternative 2, expect for the mitigation measure requiring maintenance of minimum historic low flows in the East Boulder River. This measure is required to avoid flow disruptions which would adversely affect the aquatic community.

Implementation of Alternative 8 would eliminate the potential for impacts to aquatic resources in the vicinity of the Brownlee Creek adit. The reduced volume of mine water produced would also mean less potential for impacts to aquatic communities in the East Boulder River.

Other related development activities would occur in the Stillwater Complex which could increase or decrease overall impacts of the alternatives. None of these are considered long-term, with the exception of positive impacts through the reintroduction of beaver to the East and Main Boulder Rivers. Some increased human activity could occur in the area from these other projects; however, this is not expected to be significant.

## 5.8 VEGETATION, WETLANDS, AND TIMBER RESOURCES

Approximately 233 acres of direct impact on area vegetation would occur under Alternatives 2 and 3, while a lesser amount of vegetation destruction will occur under Alternative 1. Vegetation impacts from implementation of Alternative 1 would be short-term, while impacts from Alternatives 2 and 3 would extend through the life of the mine. Alternatives 1, 2, and 3 would also likely have a negative impact on some areas

containing the small, white-flowered forb.yellow springbeauty, a species of special concern although the existence of the species in the East Boulder River drainage would not be threatened. Alternative 1 will result in the removal of approximately 30 acres from the timber base for the life of the exploration project. Alternatives 2 and 3 would require the removal of approximately 203 additional acres from timber production for a total of 233 acres. Alternatives 2 and 3 would disturb some riparian and wetland vegetation in the Brownlee Creek and East Boulder permit areas.

New road construction for both Alternatives 4A and 4B would disturb cropland, rangeland, pasture, and meadows. Both road alternatives would also intersect a series of wetlands, which may require drainage and result in reduced wetland area size. Impacts to vegetation due to road construction and usage could also result in easier opportunities for weed invasion. Impacts to timber and special plants would be the same.

Implementation of Alternative 5A or 5B would disturb vegetation along the powerline corridor. Rangelands and agricultural lands would be removed only temporarily from productive use, and immediate revegetation could actually improve production in some overgrazed areas. The disturbance created by installation of powerlines could create an opportunity for noxious weed establishment. Further comparison of impacts on vegetation regarding powerline construction cannot be made without additional baseline information.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Alternative 7 is expected to have similar impacts as Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures identified in Section 2.5. Impacts to be mitigated include long-term maintenance of a protective vegetative cover on the tailing impoundment, low visual quality due to mine facilities, possible construction in wetland/riparian communities, and possible impacts to vegetation resulting from breakouts on the East Boulder Plateau.

No habitat or vegetation losses would occur at the Brownlee Creek adit area under Alternative 8, reducing the amount of land disturbance by 3 acres from Alternatives 2 or 7.

## 5.9 AIR QUALITY

Direct impacts from Alternative 1 include increased particulate and gaseous emissions. They will be of short-term duration, extending until the exploration phase is complete. Alternatives 2 and 3 would result in longer-term ambient concentrations of pollutants for the life of the mine. Emissions would occur from construction activities, mining and milling processes, road activity, fugitive dust, and generator usage. Impacts from Alternatives 2 and 3 are expected to be equal.

Alternatives 2 and 3, and to a lesser extent Alternative 1, would result in a decrease in the overall air quality of the Stillwater Complex region.

Air quality impacts from Alternatives 4A and 4B are expected to be similar, with short-term impacts due to construction activities and long-term impacts due to dust and vehicle emissions. Impacts resulting from the road corridor proposed in Alternative 2 are expected to be similar.

Impacts for the two powerlines in Alternatives 5A and 5B are expected to be the same and of short-term duration, resulting from land clearing activities and construction.

Implementation of an Alternative 6 waste water treatment process would have no additional impacts beyond those impacts for Alternative 2. Impacts for Alternative 7 are expected to be similar to Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures identified in Section 2.5. These measures would mitigate impacts on air quality associated with road management and dust control.

Impacts to air quality resulting from implementation of Alternative 8 should be similar to those described for other alternatives, except that no air quality degradation would occur on the Brownlee Creek portion of the East Boulder Plateau. Also, air emissions may change somewhat in the vicinity of the production adits due to the increased tunneling activity and decreased power requirements. However, this impact is impossible to quantify without more specific plan information.

### 5.10 TRANSPORTATION

Roads needed to access the proposed mine area and, for some alternatives, mine breakouts or ventilation shafts, would require construction and/or upgrade. There would be an increase in road traffic for Alternatives 1, 2, and 3. Impacts from increased road traffic and road development will be relatively short-term for Alternative 1, during the exploration phase of the mine. Impacts relating to traffic for Alternatives 2 and 3 would be long-term. There would be long-term increases in road traffic and road maintenance costs, and a reduction in traffic safety to local residents. These would be direct impacts for the life of the mine. Impacts for Alternatives 2 and 3 are equal.

Alternatives 4A and 4B address different transportation routes, but they would not be expected to have any different impact on road traffic or road maintenance cost than for the proposed action. As noted in other sections, these two alternatives would have lesser impact on valley residents and wildlife than the proposed action.

In evaluating the road alternatives, three broad categories were considered. These included safety factors, cost factors, and land use factors. Table 5.10-1 shows the evaluation results, as given in the SG 31 Road and Bridge Report (HKM 1990). The ranking of these alternatives, according to this table, from most reasonable to least reasonable are: Bench, Bench/Valley, and existing SG 31. This ranking is based only on the criteria shown on the table and does not address right-of-way acquisition concerns and the financial impacts to Sweet Grass County of maintaining any new road in addition to the existing SG 31. If cost factors are excluded from the evaluation, and only safety and land use factors are considered, the rankings do not change. Agriculture is of primary importance to Sweet Grass County and impacts to this land use should be carefully examined in the Hard Rock Impact Plan. Table 5.10-2 shows a further breakdown on impacts to three different land use categories. Since the SG 31 alternative route is basically a widening of the existing road; it has the least impact on agricultural lands. The Bench Route would have the highest impact on all three land types including irrigated crop, irrigated grazing, and dry grazing. Improving the existing SG 31 alignment and using it as the access road to the proposed project would have the largest impact to local residences from dust and noise, and had the lowest safety factor rating (HKM 1990).

Alternatives 5A and 5B would not have any impact on transportation.

Implementation of an Alternative 6 wastewater treatment process would result in minimal increases in vehicle traffic during construction and operations. Treatment facility related traffic would continue for the life of the mine wastewater treatment program.

TABLE 5.10-1

EVALUATION OF ROAD ALTERNATIVES

| | Best Possible | Bench Route[b] | Bench/Valley Route[b] | Proposed Route (Existing)[b] |
|---|---|---|---|---|
| GROUP SAFETY FACTORS | | | | |
| A. Intersection Geometrics | 8 | 8.00 | 7.38 | 6.86 |
| B. Geometric Curves - 40 mph Design Speed (Posted 35 mph or less) | 8 | 8.00 | 7.58 | 5.58 |
| C. Sight Distance Impairment | 8 | 8.00 | 8.00 | 8.00 |
| D. Effect of Snow and Other Winter Factors | 3 | 0.00 | 0.56 | 3.00 |
| E. Fill Height | 8 | 8.00 | 8.00 | 4.26 |
| TOTAL SAFETY FACTORS | 35 | 32.00 | 31.52 | 27.70 |
| GROUP II - COST FACTORS | | | | |
| A. Drainage | 3 | 2.60 | 2.60 | 3.00 |
| B. Least Cost of Construction | 25 | 25.00 | 23.47 | 18.38 |
| C. Least User Cost Soils & Geology | 3 | 2.92 | 2.87 | 2.60 |
| D. Least Unstable Slope Potential | 3 | 3.00 | 3.00 | 3.00 |
| E. Grade in Excess of 6% | 3 | 3.00 | 3.00 | 3.00 |
| F. Best for Snow and Other Winter Conditions | 3 | 3.00 | 3.00 | 2.90 |
| TOTAL COST FACTORS | 40 | 39.52 | 37.94 | 32.64 |
| GROUP III - LAND USE FACTORS | | | | |
| A. Impact on Irrigated Land | 10 | 2.88 | 4.14 | 10.00 |
| B. Proximity to Residence (Impact from Dust & Noise) | 10 | 10.00 | 6.36 | 0.00 |
| C. Number of Individual Property Ownership Involved | 5 | 5.00 | 4.44 | 3.64 |
| TOTAL LAND USE FACTORS | 25 | 17.88 | 14.94 | 13.64 |
| GRAND TOTAL GROUP I, II & III | 100 | 89.40 | 84.40 | 73.98 |
| RANKING OF ALTERNATIVE ROUTES | | BEST | 2ND BEST | 3RD BEST |

[a] For the HKM study, weights of criteria were developed by the three groups of variables. Weighting of each variable ranged from a lowest value of 3 to the highest value of 25 (least construction cost).

[b] For each weighted variable, the most suitable alternative was assigned the maximum weight. The other alternatives were ranked with value less than the maximum weight. The alternative with the lowest score was considered the least attractive to the given criterion.

Source: HKM 1990

## TABLE 5.10-2

## LAND CATEGORY RATINGS

| Route | Type of Land | Length (1,000 feet) Each Type | Ratio of Taxable Value | Impact | Adjusted Impact Factor | Route Impact Totals |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Valley (SG 31) | Irrigated Crop | 11.1 | 8.53 | 94.7 | 18.9 | 23.3 |
| | Irrigated Grazing | 17.8 | 1.25 | 22.2 | 4.4 | |
| | Dry Grazing | 0 | 1.00 | 0 | 0 | |
| | Acres Affected | | | | | |
| | Irrigated Crop | | | | | |
| Bench/Valley | Irrigated Grazing | 7.4 | 8.53 | 63.1 | 30.4[a] | 56.3 |
| | Dry Grazing | 20.7 | 1.25 | 25.9 | 25.9 | |
| | Acres Affected | 0 | 1.00 | 0 | 0 | |
| | Irrigated Crop | | | | | |
| Bench | Irrigated Grazing | 6.3 | 8.53 | 53.7 | 53.7 | |
| | Dry Grazing | 21.8 | 1.25 | 27.2 | 27.2 | 80.9 |
| | Acres Affected | 0 | 1.00 | 0 | 0 | |

[a] Product of 2.6 x 1.0 (Bench) plus 48 x 0.2 (Valley) = 3.56 adjusted length x 8.53 = 30.4

The Valley Route with a Column (7) Route impact total of 23.3 is best and therefore is given the full rating of 10.00. Other routes rate down from 10.0 for the Valley Route in ratio of their route impact total to the 23.3 impact total for the Valley Route. Thus, the Bench Route rates 10 x 23.3 divided by 80.9 = 2.88; the Bench/Valley Route rates 10 x 23.3 divided by 56.3 = 4.14; and the Hill Route rates 10 x 23.3 divided by 77.6 = 3.00.

Acres Affected are an estimate prepared by the agencies of additional land required for implementation of the route. For instance, the Valley route requires less additional acreage because it is merely the amount required for upgrade and road expansion, whereas the Bench and Bench/Valley routes require significantly more new land for road development. Assumptions include all roads will be 40 feet wide, including shoulders.

Source: HKM 1990

Alternative 7 would have similar impacts as Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures identified in Section 2.5. Impacts to be mitigated include increased traffic through the East Boulder River valley, road management, dust control, snow removal, vegetation control, runoff and erosion control, employee parking, and conflicts with school bus traffic. Alternative 8 would present no variation in impacts compared to Alternative 2.

Other related development activities such as a timber sale could result in a short-term increase in vehicular traffic, but the increase would not likely be great, relative to the dramatic traffic changes that would be caused by implementation of Alternatives 2 and 3.

## 5.11 LAND USE

Short-term indirect land use impacts to East Boulder River valley residents will be associated with implementation of Alternative 1 because of the increased noise and traffic. Alternatives 2 and 3 would create a long-term indirect impact to these residents. Some low direct impact will be caused by Alternative 1 to FS Management Area 8 because of timber harvesting. A much greater impact would occur to timber lands under Alternatives 2 and 3 because of the larger amount of acreage (>200 acres) cut.

Alternatives 2 and 3 would have an impact on land use patterns in Big Timber and possibly near the project area due to residential and commercial development. This may result in a loss of agricultural or rangeland acreage.

Moderate to high long-term impacts would be caused to irrigated agricultural lands through the implementation of Alternatives 4A or 4B. This would primarily result in a loss of agricultural fields. Use of the road route in the proposed action (Alternative 2) would not have this impact.

A short-term impact on agricultural or ranch lands due to implementation of Alternatives 5A or 5B would occur during construction, and the potential exists for a long-term reduction in agricultural lands if power distribution poles or lines impact irrigation devices.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Alternative 7 would have the same impacts as those identified for Alternative 2. No additional mitigation measures were identified for land use. No mining would occur in the Brownlee Creek adit area under Alternative 8, thus preserving approximately 3 acres for wildlife habitat and recreational use.

## 5.12 VISUAL RESOURCES

Short-term impacts resulting from area disturbance and color contrasting will occur during mine exploration activities (Alternative 1). These would be expected to recede when exploration ceases and reclamation takes place, if Alternatives 2 or 3 do not take place. A greater area of disturbance would result in greater visual impact during implementation of Alternatives 2 or 3. An increased impact would result from construction of the tailing impoundment, which would cause a considerable impact on the foreground distance zone. Reclamation would reduce but probably not eliminate this impact after mine operations cease. Alternative 3 would reduce the line element of visual contrast to the tailing impoundment relative to the proposed action (Alternative 2), thereby reducing visual impact to some extent.

During construction activities, Alternatives 4A and 4B would cause high visual impacts, much greater than the visual impact caused by road reconstruction in Alternative 2. This would be reduced some during the operational phase. Visual impacts would be greater during construction and operation if powerlines were sited along the new road alignment.

Visual impacts resulting from installation of new powerlines in Alternatives 5A and 5B would be high and long-term relative to the existing landscape, although a lack of baseline information prevents a firm analysis of this issue.

Implementation of an Alternative 6 wastewater treatment process would result in the possible addition of facilities to facilities planned in Alternative 2. Additional visual impacts could result for the life of mine and for the life of the treatment facilities. Alternative 7 would have the same impacts as Alternative 2, except for those impacts which would be reduced or eliminated by mitigation measures identified in Section 2.5. Impacts to be mitigated include low visual quality in areas such as the tailing impoundment, the millsite, the East Boulder Plateau, and the area between FS 205 and the East Boulder Campground.

No degradation of visual quality would occur in the Brownlee Creek adit area under Alternative 8 since there would be no disturbance and facilities development.

### 5.13 RECREATION AND WILDERNESS

Implementation of Alternative 1 will likely impact recreational opportunities along the East Boulder River and access to the wilderness for the short-term, but completion of exploration will likely return both to the preexploration state. Direct short- and long-term impacts to fishing quality, hunting quality, and dispersed recreation would result from implementation of Alternatives 2 or 3. These impacts are projected to be moderate to high. The quality of scenic driving experience and other outdoor activities such as bird watching would be reduced due to the increase in traffic on access roads. The opportunities for solitude in the Absaroka-Beartooth Wilderness would occasionally be disrupted from noise generated from construction activities, particularly in the Placer Basin.

No impacts on recreational opportunities or wilderness are expected from Alternatives 4A or 4B, or 5A or 5B.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Implementation of Alternative 7 would result in similar impacts as Alternative 2, except for the impacts which would be reduced or eliminated by mitigation measures identified in Section 2.5. The impacts to be mitigated include snowmobiling on plowed roads, parking for recreationists, and access to the Dry Fork and Lewis Gulch for public recreationists.

No impacts to the existing recreational quality would occur at the Brownlee Creek adit area under Alternative 8.

## 5.14 SOCIOECONOMICS

Socioeconomic effects resulting from implementation of Alternative 1 are considered minimal compared to Alternatives 2 and 3. Short-term impacts to the local economy will result from mine exploration activities, but these will cease at the end of this phase. Direct, long-term socioeconomic impacts resulting from Alternatives 2 or 3 implementation would be high, and are detailed in Subsection 4.14. Impacts from Alternatives 2 and 3 are considered equal.

Impacts resulting from development of an alternative road corridor, as described in Alternatives 4A and 4B, would be different in magnitude and scope. Short-term impacts resulting from construction would likely be greatest for Alternatives 4A and 4B, due to much more extensive road development. However, long-term impacts from the proposed road route (Alternative 2) would probably result in greater dissatisfaction among East Boulder River valley residents than long-term impacts from either 4A or 4B.

Implementation of an Alternative 6 wastewater treatment process would have no additional impacts beyond those impacts for Alternative 2. Impacts from Alternative 7 would be the same as Alternative 2. No additional mitigation measures were identified for socioeconomics. Impacts would not change as a result of the implementation of Alternative 8.

## 5.15 NOISE

Implementation of Alternative 1 will result in short-term increases in noise levels, both during construction activities as well as operation. Alternatives 2 and 3 would result in increased noise levels over Alternative 1 and these would be considered long-term.

Noise impacts from construction activity would be short-term in order to build roads described in Alternatives 4A and 4B. Although the noise levels using either of these two alternatives would probably be greater than for the proposed (valley) road route (Alternative 2), the impact of increased noise on the current road would be much greater due to the proximity of residents in the valley. Similarly, long-term noise impacts from the proposed road route would be greater than for either of the two alternative routes, which are expected to be similar.

Noise impacts for each power supply alternative would be similar. The impacts would be short-term, resulting from construction equipment and vehicles. Very minimal noise impacts (a soft hissing and cracking sound) would occur during operation of the power transmission line during wet weather.

Implementation of an Alternative 6 wastewater treatment process would possibly result in additional noise and higher levels during operations beyond that described for Alternative 2. Elevated noise levels at the site and along the access road could continue for the life of the treatment facilities.

Implementation of Alternative 7 would result in similar impacts as Alternative 2, with the exception of impacts which would be reduced or eliminated by mitigation measures outlined in Section 2.5. These mitigation measure are designed to reduce noise impacts in the wilderness area.

Under Alternative 8 noise levels would be reduced on the East Boulder Plateau since construction and operations activities would not occur at the Brownlee Creek permit area.

The Environmental Impact Statement (EIS) process was initiated by Montana Department of State Lands (DSL) and Gallatin National Forest (GNF) in response to a request made by Stillwater PGM Resources (SPGMR) for a mine operating permit submitted to the agencies in February 1990. After subsequent revisions prepared in response to deficiencies in the original submittal, the permit application was deemed complete by the agencies on August 22, 1990. Notification of the agencies' intention to prepare the EIS and announcement of the public comment period regarding the scope of the EIS was published in the Federal Register on June 15, 1990, and in local and area newspapers.

To identify issues and concerns associated with the proposed action, the agencies held a public scoping meeting in Big Timber, Montana, on June 28, 1990. Prior announcement of the meeting was made using press releases, mailed notices, and public service announcements. Approximately 170 people attended the meeting, which lasted about two hours. Representatives from the lead agencies and their EIS consultant, as well as SPGMR, were present. Following initial remarks about the proposed mine plan and the EIS process, attendees were divided into discussion work groups for about 45 minutes to record individual issues and concerns. Following this step, the entire group reconvened to hear the results of the working group sessions. Comments, suggestions, and concerns about the project and associated EIS were gathered during the meeting and compiled into a Summary Paper, which was mailed to all meeting attendees. Written comments about the proposed action were also received during the 45-day scoping process period which followed the public meeting. A summary of concerns raised by individuals and organizations during the initial scoping process is contained in Appendix A.

Another public meeting was held in Big Timber on September 5, 1990, to present preliminary alternatives identified during the scoping process to the public, and to solicit additional comments. In addition, the agencies have held other, less formal meetings with interested parties throughout the development of the draft EIS. The issues and concerns raised by the public during scoping were used in the development of alternatives in Chapter Two and were addressed in the analysis for the EIS in Chapter Four.

The draft EIS was published and released to the public on May 7, 1991. The Notice of Availability appeared in the Federal Register on May 10, 1991, which started the official 45-day public comment period. After the publication of the draft EIS, SPGMR proposed an alternate method of accessing the mine ore body. The agencies considered this a "substantial change in the proposed action that is relevant to environmental concerns;" therefore, a supplement draft EIS was prepared and released to the public on August 12, 1991. The Notice of Availability appeared in the Federal Register on August 30, 1991, and the comment period for both the draft and the supplemental draft extended to October 15, 1991.

Public meetings were held in Big Timber, Montana on June 5, 1991, and September 11, 1991, to accept public comments on the draft and supplemental draft EISs. Transcripts of comments from these meetings are included in this chapter (See Section 6.1.2).

The DSL and GNF received 44 comment letters on the draft and supplemental draft EISs. A listing of individuals, groups, and agencies who submitted comments in letters or testimony is presented in Section 6.1.1. Copies of the letters and transcribed testimony follow in Section 6.1.2. Specific comments, which have been addressed by the agencies, are identified on each letter or transcribed testimony. Responses to these comments are presented in Section 6.1.3. The listing of individuals, groups, and agencies which were mailed a copy of the final EIS is presented in Section 6.2.

Major concerns expressed by the public focused on degradation of surface water and groundwater, transportation, reclamation, and socioeconomics. Revisions and additions have been made to the text in this

final EIS to address these concerns where appropriate. The agencies have identified their preferred alternatives in this final EIS (see Section 2.8), including a road alternative and powerline alternative.

## 6.1 COMMENTS AND RESPONSES TO THE DRAFT EIS

### 6.1.1 Listing of Commentors

Following is list of agencies, organizations, and individuals who submitted written and/or oral comments on the draft EIS for the East Boulder Mine Project to the Department of State Lands, the Gallatin National Forest, or the Department of Health and Environmental Sciences. In Section 6.1.2, the letters and testimony are reproduced in the same order and with the same letter number as shown here. The letters are organized in the following order: public agencies first, followed by organizations, followed by individuals. Each group of letters is ordered according to the date they were written or received.

| Letter Number | Commentor |
|---|---|
| | Agencies |
| 1. | United States Environmental Protection Agency |
| 2. | United States Environmental Protection Agency |
| 3. | United States Department of the Interior, Office of Environmental Affairs |
| 4. | United States Department of the Interior, Office of Environmental Affairs |
| 5. | United States Department of the Interior, Fish and Wildlife Service |
| 6. | Montana Department of Fish, Wildlife, and Parks |
| 7. | Montana Department of Fish, Wildlife, and Parks |
| 8. | Montana Department of Natural Resources and Conservation |
| | Organizations |
| 9. | Dude Tyler, Cottonwood Resource Council (agency notes of his comments at June 5, 1991 hearing, not an exact transcription of his statements) |
| 10. | Jean Clark, Pat Clark, Cottonwood Resource Council |
| 11. | Dude Tyler, Cottonwood Resource Council |
| 12. | Dude Tyler, Cottonwood Resource Council |
| 13. | Louise Bruce, Montana Wilderness Association |
| 14. | Paul Hawks, Northern Plains Resource Council |
| 15. | Jean Clark and Paul Hawks, Northern Plains Resource Council |
| 16. | Joe Gutkoski, Madison Gallatin Alliance |
| 17. | Jeanne-Marie Souvigney, Greater Yellowstone Coalition |
| 18. | Bruce Gilbert, Stillwater PGM Resources |
| 19. | Scott Mason, Hydrometrics, Inc. |

Individuals

20. Beth Deegan
21. Lloyd Braughton
22. Jim Stoltz
23. Warren D. Bowman and Vikki Fenton Bowman
24. Dolores L. Anstett and Arthur W. Anstett
25. Francis Blake
26. Thomas McNamee
27. Farwell Smith
28. Farwell Smith
29. Linda McMullen
30. Linda McMullen
31. Sue Glidden
32. Ralph Glidden
33. William R. Hjortsberg
34. Dave Gano
35. Quinten Ehley
36. Steve Pauli and Susan Pauli
37. Sally Gingras
38. Jane W. Favinger
39. Jim Woolsey and Beryl Woolsey
40. Linda Iverson
41. Jerry Iverson
42. Reid Carron
43. Mark Thurber
44. Frank Lohrer
45. Mimi Kiser

Testimony

46. William Snyder, Greater Yellowstone Coalition - comments from open house held on June 5, 1991
47. Testimony from public meeting held on September 11, 1991

### 6.1.2 Comment Letters and Transcriptions

The full text of the letters and transcription of the testimony received on the East Boulder Mine Project draft EIS are reproduced on the following pages. In the interest of conserving space, the letters have been reduced and placed four to a page, organized such that they read top to bottom on the left side of the page, then top to bottom on the right side of the page. A double-lined break indicates the end of a letter or transcribed testimony.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII, MONTANA OFFICE
FEDERAL BUILDING, 301 S. PARK, DRAWER 10096
HELENA, MONTANA 59626-0096

JUL 18 1991

Ref: 8MO

July 15, 1991

David P. Garber
Forest Supervisor
Gallatin National Forest
P.O. Box 130
Bozeman, Montana 59703

Re: East Boulder Mine Project
Draft Environmental Impact
Statement

Dear Mr. Garber:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Environmental Protection Agency's Region VIII Montana Office (EPA) has reviewed the above-referenced Draft Environmental Impact Statement (DEIS).

The proposed East Boulder Mine Project consists of an underground mine (Platinum/Palladium), mine entrance, ore processing mill, mine/mill support complex, tailing retention impoundment, new power transmission lines, and access roads. The project is located approximately 30 air miles north of Yellowstone National Park. A total of 844 acres, located in three separate regions, will be affected by the mine project. The lifetime of the mine is expected to be 27 years, with an average annual production rate of 730,000 ore tons. Approximately 2.6 miles of new road and upgrading of 26 miles of existing road is expected.

There were seven (7) total alternatives developed, including a 'no action' alternative, to address various actions or facility needs. The agencies involved have identified Alternative 7 as their preferred alternative. However, a preferred road alternative, preferred power line route, and preferred water treatment alternative have not been chosen. Apparently, the agencies have also decided to publish a supplement to the Draft EIS which is to include a 'new alternative'. EPA would welcome any advanced specific's of this new development. **1-1**

In NEPA terms, an environmental impact statement is to be a reflection of the factual information and considered analysis presented by the Forest Service (CFR 40 1506.5a). In a number of places there are statements similar to "SPGMR believes that the low concentrations expected in East Boulder mill will biodegrade **1-2**

rapidly, although an analysis of biodegradation potential has not been performed using site-specific factors." If an independent analysis supports this or other conclusions, then the Forest Service should so state. Conclusions based upon unsupported beliefs of the project proponent are not relevant in any EIS document. **1-2**

Perhaps most alarming is Section 2.1 (paragraph 1) which states, "This EIS fulfills DHES's responsibilities to assess the required alternatives." Given that it is stated in a number of sections within the DEIS that the antidegradation standard will be violated, EPA does not believe that alternatives to violating these standards have been sufficiently developed at this time. Such are the stated goals of NEPA, to develop alternatives which do not degrade the present environment. **1-3**

EPA finds this DEIS full of statements which lack the adequate data or disclosure of assumptions to make them creditable. Statements of affect should be quantified, should be included in the assessment of cumulative impacts, and should provide a rational discussion of the level of uncertainty associated with it. **1-4**

EPA was pleased to see the Forest Service's evaluation of project area wetlands as delineated in accordance with the Federal Interagency Wetlands Delineation Manual.

In accordance with the criteria that EPA has established for rating Draft Environmental Impact Statements, EPA has rated this DEIS as category EC-2 (Environmental Concerns - Insufficient Information). EPA concerns are developed from the uncertainty of a supplemental DEIS; non-selected preferred alternatives; a new alternative number eight; and specific concerns with impacts on water quality/aquatic life. EPA is also concerned with the lack of sufficient information needed to evaluate conclusionary statements made in the draft. A <u>Summary of Rating Definitions</u> sheet is attached.

EPA does look forward to working with the Forest Service and the other agencies to derive a mutually acceptable document. If EPA can be of further assistance, please contact Jeff Bryan of my staff at (406) 449-5486 or FTS 585-5486.

Sincerely,

John F. Wardell

John F. Wardell, Director
Montana Office

Enclosure



cc: Jennifer Harris, 8WM-EA
Dawn Roberts, OFA-A104
Jo Stephen, MDSL
Orville Kiehn, 8WM
Bob Erickson, 8WM-WQ



DETAILED TECHNICAL COMMENTS BY THE U. S. ENVIRONMENTAL PROTECTION AGENCY: THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR EAST BOULDER MINE PROJECT

<u>Water Quality</u>:

The Boulder River, East Boulder River, and tributaries Brownlee, Canyon, and Dry Creeks may potentially be affected by mine construction, operation, and post mining closure/reclamation. There does not appear to be any water quality data on the tributaries or on the Boulder River, **1-5** and the water quality data on East Boulder River is insufficient as a basis for determining ambient conditions or determining compliance with numeric or antidegradation standards. **1-6**

Table 3.2-1 displays water quality data from East Boulder River "upstream of proposed East Boulder Adit Facilities". The following problems exist for this data:

- There is no location map to precisely identify sample locations for Forest Service and Hydrometrics data; **1-7**
- evaluating the data for representativeness and usefulness is not possible because of the lack of information on sample size (n), dates of collection, and flow regimes at the time of sampling. Two to seven samples for non-metals is most likely not representative and it is problematic what "metals analysis reflect 1991 sampling event" means in terms of number of samples and representative time of year; **1-8**
- No samples for hardness are reported, which are crucial for establishing toxicity for a number of metals. **1-9**

The accurate prediction of whether numeric or antidegradation standards will be met during construction/operation is also a function of the accuracy of flows and concentrations of ground and surface flows into receiving water bodies as well as the accuracy of ambient water quality. The EIS states there is uncertainty in the estimates but does not go on to perform a sensitivity analysis showing what conditions might occur if resultant concentrations are more and dilution less than estimated. **1-10**

Good hydrologic data is also necessary for an accurate assessment of water quality impacts in terms of concentrations and frequency of exceedances. This is important, since water quality exceedances are only allowed once in three years. The East Boulder River flow measures appear to be based on only four years of records (Chapter 3, page 7), with an observed low flow of 5.3 cfs. Because of the fairly few water quality data **1-11**

available, the likelihood that these were not taken during winter low flows, and the possible increased losses of stream flow from the proponent's surface right and 200 gpm ground water usage, the use of the 5.3 cfs flow as dilution seems unreasonably high to EPA. A further analysis and justification of the dilution flow is needed. 1-11

EPA notes the following surface water quality impacts:

- seepage from tailings dam to ground water to surface water;
- seepage from percolation ponds to ground water to surface water;
- erosion from roads, power corridors, primary mine area, and adit areas;
- metals leached from tailings in tailings ponds and mine rock used for other above-ground purposes;
- seepage from the septic system;
- accidental spills from all chemicals used in mining and milling - petrochemical products for vehicles and mine/mill machinery -- on site storage and trucking considerations.

Water quality and aquatic life impacts from each of these sources above should be summarized on one table to allow assessment of each impact separately and cumulatively. How will the water quality of the tailings pond change over time? Do estimates of water quality include periods after significant evaporation? EPA asks that a full discussion of data limitations and assumptions in analyses and conclusions be provided. The DEIS states that an assay of tailings water quality for the existing Stillwater mine can be found in Appendix D of the Plan of Operations. EPA requests that this data be made available as soon as possible. 1-12

EPA asks what impact will there be from the Frog Pond waste rock disposal area? 1-13 Will mine water be used for dust control? 1-14 Is there potential for the evaporated residual to enter surface waters? How will stockpiled soils be protected from erosion? 1-15

The cumulative impacts discussion (Chapter 4, page 24) does not address the cumulative effects of all projected activities on water quality, and subsequently, on aquatic life. Changes in sediment loading from the roads, the three mine and adit sites, and any other disturbed areas must be summed. In assessing impact of sediment, a percentage of the yearly sediment load, is not adequate. Maximum changes in sediment load for any day of 1-16



the year is more appropriate in assessing impact. Similarly, effects on other water quality parameters should be summed from mine water, tailings impoundment percolation ponds, runoff from the mine and adit areas, and from haul roads. 1-16

A realistic assessment of accident potential for the large amount of truck traffic as well as storage and use of process and vehicle chemicals should be made. Within the 27 year project life both major and minor accidental spill are very likely to occur.. The effects of and probable frequency of these spills on aquatic life of all streams, including the main Boulder River and possibly further downstream, should be made as part of the impact assessment. The Boulder River is a tributary of the Yellowstone and may be affected by cumulative impacts as well as accidental spills. 1-17

EPA recognizes hardness as an important component in standards and aquatic toxicity, more specific data for all potentially impacted streams is needed. The assessment of chronic standards to be met (Table 4.2-3) is based on a hardness of 100, however, Chapter 3, page 7, Surface Water Quality suggests a value of less that 60mg/l and may be considerably less. Chronic standards could be half or less of those shown on the table, considering lower hardness values. In addition, seasonal hardness values should be used if data are to be averaged. 1-18

Although reference is made in several places to the probable violation of antidegradation standards, the calculations to support the magnitude and frequency of exceedances from ambient conditions is not presented. Calculations and assumptions to support all conclusions of compliance or noncompliance with numeric and antidegradation standards and the frequency of elevated levels should be presented as part of the appendix. Calculations should account for the uncertainty of the data on ambient as well as mine-related water quality in predicting resultant concentrations. 1-19

For water quality purposes the DEIS bases mine discharge water quality on a single sample in December for the Stillwater mine. This may or may not be typical of other months of the year and the assumptions that the PGM Mine will have the same characteristics is speculative. At a minimum, the mine and tailings water quality should be characterized by four (4) sample periods. On page 30 of Chapter 2, EPA asks what 1991 data is being referred to and where was it taken? 1-20

EPA has concern about statements like "...expects to meet drinking water standards," as are common throughout this draft document (Chapter 2, page 30, example). Conclusions should be made by the Forest Service and the conditions or assumptions under which standards would not be met specified. Similarly, 1-21



(Chapter 2, page 47) statements like "SPGMR has indicated in the Plan of Operations that due diligence will be used...to insure that foreseeable situations involving damage to the human and environmental communities are avoided", do not provide sufficient assurance that damage will not occur. "Indicated" does not say will; due diligence is not defined; a well designed monitoring program that addresses precision, accuracy, and all areas that might be impacted is necessary to detect damage, and a commitment in writing as to what will be done if damage is detected (including all operational definition of damage) is required. 1-21

Section 2.4.4. - Water Treatment Methods, states that modeling "indicates" that water quality from the mine discharge water mixing with ground and surface water "would likely not exceed drinking water or water quality criteria." EPA requests all calculations and assumptions to back up this statement plus a sensitivity analysis of the likelihood of exceedance occurring given the data base and assumptions, be provided. 1-22

EPA is also very concerned with streamflow disturbances that may result from mine operations. Can assurances be made that surface flows won't disappear as with portions of Nye Creek at the Stillwater underground mine? 1-23 Will bonding be adequate in the long term to address all potential threats to water quality? Threats like loss of surface flows, instream biological community impacts, drinking water source impacts, catastrophic tailings failure, and others. 1-24

The DEIS states that there will be leakage/seepage of 0.4 gpm from the lined tailings pond. The liner will be 1/10 inch plastic, covering some 80 acres. EPA asks what the burst strength or loading safety factor is for this liner? Considering the large area and problems ensuring the integrity of the liner, a 0.4 gpm appears extremely low. What specific volumes will be discharged to the pond? Could calculations and assumptions as well as experiential data be provided from other mines? 1-25

EPA requests that this document characterize the ore as to chemistry, mineralogy, and acid production potential. Similarly, characterize mining waste materials, including mine footwall, mine crosscut, and mill tailings to be used in mine backfill (coarse particles) and tailings pond slimes. 1-26

The DEIS should summarize the predictive climatology and include these data (evaporation/precipitation) in the site water balance. 1-27

EPA requests for clarification labeling Figure 2.3-7 (Mill Flow Sheet) process flows to identify cleaner tailing, scavenger cleaner tailing, scavenger concentrate, recleaner tailing and flash flotation tailing pulp streams. 1-28



Identify treatment alternatives for the dissolved metals component of the permanent wasterock storage pile/piles-runoffs if the aqueous phase may not meet state water quality standards. 1-29

Although a location map (Figure 3.3-1) was provided in the DEIS to indicate ground water well locations, it is not clear to EPA what the areal extent of the aquifer is to determine the potential threat of seepage from percolation ponds. A plan-view and cross-sectional view of aquifers in the mine project area should be provided and the ponds sited accordingly. To what degree, if any, does groundwater here serve currently or potentially as drinking water sources? 1-30

EPA is somewhat confused over the correct tailings dam slope listing. Is this proposed at 1.6:1 or 2:1? This conflicting information should be clarified. Would a flatter even more stable slope, other than 2:1, be feasible? 1-31

<u>Water Quality Monitoring</u>:

Instream sediment monitoring at upstream and downstream locations in relation to the mine should be done with a statistically valid sampling design before and after mine construction. Sample times should be prior to spring runoff and just before fall spawning. Potential spawning areas should be given priority for sample sites. This is in line with stated Forest Service goals to "protect fisheries habitat." 1-32

Because of the potential for mercury contamination and the high detection limits in relation to chronic standards, a program of fish flesh analysis for mercury should be instituted prior to construction and continuing annually during operation. 1-33

Future water quality monitoring should include both dissolved and total recoverable measurements of metals and should specifically include hardness measures. 1-34

The proposed quarterly monitoring (Chapter 2, page 47) is not adequate to protect water quality and aquatic life. This should be changed to monthly at a minimum. 1-35

In Chapter 2, page 47, the statement is made that the PGM monitoring will "resemble the monitoring program now in place at the "Stillwater Mine." The PGM monitoring should be site specific and references to another monitoring plan, without providing that plan, is unacceptable. Statements such as "frequent" monitoring, without defining frequent, and "changes will be made as required" provide no basis for evaluation. Detailed commitments to what will be done should be provided. 1-36

EPA would highly recommend that biological monitoring be performed above and below the mine on the East Boulder River and on Brownlee Creek to verify and document that adverse impacts to area surface waters and aquatic communities will not occur from mine operations. The biological communities in these streams will integrate the effects of different pollutant stressors over time and provide a means of detecting mine impacts. EPA requests that a detailed monitoring plan, incorporating biological monitoring (e.g., EPA Rapid Bioassessment Protocols or the equivalent), be developed and displayed in the FEIS. Very little information was presented in the DEIS on benthic life in potentially impacted streams. **1-37**

AIR

EPA was concerned with several conditions listed in Section II of Appendix C - Preliminary Determination on Air Quality Permit Application, as follows:

H. Why are nitrogen oxide emissions based on 65 tons per year? The State of Montana has an hourly standard! EPA also finds the use of manufacturer's information to verify emission levels as unacceptable. This condition would certainly not protect the hourly standard, only performance testing would be appropriate here. **1-38**

I. EPA believes a record keeping and reporting system requirement is mandatory to enforce fugitive dust control. **1-39**

J. Here again, EPA has determined that a record keeping and reporting requirement is absolutely necessary for air compliance. **1-40**

EPA also strongly suggests that an item M be added which addresses the need for temporary and permanent closure plans for the tailings impoundment. **1-41**



SUMMARY OF RATING DEFINITIONS

ENVIRONMENTAL IMPACT OF THE ACTION

LO--LACK OF OBJECTIONS

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC--ENVIRONMENTAL CONCERNS

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO--ENVIRONMENTAL OBJECTIONS

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--ENVIRONMENTALLY UNSATISFACTORY

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potentially unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

ADEQUACY OF THE IMPACT STATEMENT

CATEGORY 1--ADEQUATE

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

CATEGORY 2--INSUFFICIENT INFORMATION

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

CATEGORY 3--INADEQUATE

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Impacting the Environment."

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII, MONTANA OFFICE
FEDERAL BUILDING, 301 S. PARK, DRAWER 10096
HELENA, MONTANA 59626-0096

Ref: 8MO

October 9, 1991

David P. Garber
Forest Supervisor
Gallatin National Forest
P.O. Box 130
Bozeman, Montana 59703

Re: East Boulder Mine Project
Supplemental Draft Environmental Impact Statement

Dear Mr. Garber:

In accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Environmental Protection Agency's Region VIII Montana Office (EPA) has reviewed the above-referenced Supplemental Draft Environmental Impact Statement (SDEIS).

A proposed modification has been made to the Draft EIS, referred to as Alternative 8, as described in this supplemental document. Twin adits (13 1/2 feet in diameter), instead of a single 16-foot diameter adit, is proposed as primary mine access. An additional 28,000 cubic yards of waste rock will be generated from the second adit. This is stated as only a one (1) percent increase over the original proposed action (life of the mine production). Actual waste rock increase is listed as approximately twelve (12) percent (chapter 4, page 15). **2-**

Several advantages of Alternative 8 stand out as very positive. The elimination of the Brownlee Creek adit will negate impacts to ground water, surface water, aquatics, area soil disturbance, wildlife habitat, and noise. With the elimination of this adit, less ground water is expected to enter into the mine and subsequently a lowering of overall water degradation.

EPA feels that Alternative 8 is a very valid alternative, one which does reduce the impacts of mine development on a specific area. EPA is hopeful that our original Draft EIS comments are being fully addressed. Those particular concerns (water quality, aquatics, preferred alternatives, air quality) still remain and are the basis for our continued rating category of EC-2 (Environmental Concerns - Insufficient Information). We have enclosed for your convenience another Summary of Rating Definitions sheet. **2-2**

EPA would be glad to discuss any concerns the Forest Service has with EPA comments before the issuance of the Final EIS. Please feel free to contact Jeff Bryan of my staff at (406) 449-5486 or FTS 585-5486.

Sincerely,

William E. Engle

for John F. Wardell, Director
Montana Office

Enclosure

cc: Phyllis Williams, 8WM-EA
Dawn Roberts, OFA-A104
Jo Stephen, MDSL
Orville Kiehn, 8WM
Bob Erickson, 8WM-WQ

United States Department of the Interior

OFFICE OF THE SECRETARY
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DENVER FEDERAL CENTER, BUILDING 56, ROOM 1018
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DENVER, COLORADO 80225-0007

TAKE PRIDE IN AMERICA

JUL 5 1991

July 2, 1991

ER 91/482

Sherm Sollid, Geologist
Gallatin National Forest
P.O. Box 130
Bozeman, Montana 59771

Dear Mr. Sollid:

The Department of the Interior (DOI) has reviewed the Draft Environmental Impact Statement (DEIS) for the East Boulder Mine Project, Gallatin National Forest, Sweet Grass County, Montana and has the following comments.

Fish and Wildlife Resources

The Fish and Wildlife Service (FWS), in a letter dated June 14, 1991 concurred with the Forest Service that this project is not likely to adversely effect threatened or endangered species.

The Final Environmental Impact Statement (FEIS) should address the issue of bird collisions with power lines. The proposed power line routes should be surveyed to identify areas where bird collisions would be likely. Such areas include waterfowl concentration sites and raptor roosting, nesting, and foraging areas. River and wetland crossings of power lines should be avoided when possible. If such crossings or other collision-prone areas cannot be avoided, power lines should be constructed to maximize their visibility to birds by one or more of the following design modifications: (1) removal of the static line, (2) enlargement of the static line, and/or (3) affixing yellow spiral line markers or equally visible line markers to the static line. 3-1

Because peregrine falcons have recently been reintroduced in the vicinity of the East Boulder River, peregrine nests may be located in suitable habitat near the mine. Therefore, we recommend that annual surveys of suitable peregrine falcon nesting habitat be conducted in areas where there is potential for disturbance from mine-related activities. The FEIS should specify, as stated in the Environmental Assessment, that if peregrine nest(s) are found, helicopters will not be permitted to fly within one mile of any such nest. 3-2



The DEIS appears to adequately treat potential impacts to wetlands. However, if it is found that a Corps of Engineers' Section 404 permit is required for project implementation, the DOI, through FWS, may make additional comments concerning wetlands, based upon any new information available at that time.

Cultural Resources

The Stillwater Ultramafic Complex, a proposed National Natural Landmark, is within the project area. A description of this complex is enclosed. Status as a National Natural Landmark is granted only to those sites containing one or more ecological or geological feature(s) characteristic of a particular natural region and determined to be of national significance.

The FEIS should describe any project-related impacts to the proposed National Natural Landmark and should list measures that will be taken to protect the ecological and geological features of the area. Information on the National Natural Landmark Program may be obtained from Ms. Kay Salazar by writing to the National Park Service, Rocky Mountain Regional Office, P.O. Box 25287, Denver, Colorado 80225, or by calling (303) 969-2850 or FTS 327-2850. 3-3

Mineral Resources

The Bureau of Mines raised the following concerns, which should be addressed in the FEIS, pertaining to Alternative 3 (modifications to change the tailings dam slope angle from 1.6:1 to 2:1):

- Stability: The area on which the site is located is suitable from a geotechnical point of view, and the design of 1.6:1 is structurally sound as evidenced by a similar design at the neighboring Stillwater Mine. 3-4

- Slope Reclamation: The difference in slope angles is minuscule in a visual comparison. Armoring of the slope face will provide additional erosion protection. Stillwater PGM Resources proposes to riprap (armor) the face of this dam and revegetate with trees and grasses. This is a reclamation plan that is both conducive to this slope angle and aesthetically pleasing with the surrounding environment. 3-5

- Mine Life: Decreasing the slope angle from a 1.6:1 to a 2:1 will decrease the capacity of the tailings pond, thus decreasing mine life. Estimates on the reduced mine life contained in the DEIS (Alternative 3 p. 2-65) are 2.5 years. In this case, an additional tailing site may have to be considered prior to mine closure. The result is an unnecessary environmental impact to the surrounding area. 3-6



- Material Balance: Another problem in reduced slope angle is the waste rock material balance. Is there enough additional coarse material available from the mining operation to facilitate the additional material required for the lower slope angle? 3-7

We suggest that the proposed soil survey (p. 4-36) of the openings (ventilation breaks) on the East Boulder Plateau is not necessary. These small breakouts will have little effect on the environment, given the exits are located on rock outcrops, thus resulting in minimal surface disturbance. 3-8

Sincerely,

Robert F. Stewart

Robert F. Stewart
Regional Environmental Officer

Enclosure

cc: Ms. Jo Stephen
Project Coordinator
Montana Department of State Lands
Capitol Station
Helena, Montana 59620.



Name of Site: Stillwater Ultramafic Complex

Location: The region of concern is principally the Chrome Mountain-Contact Mountain area between the East Boulder River and Boulder River in Sweetgrass County, Montana. The proposed site includes Sections 8, 9, 10, 15, 16, 17, 20, 21, 22, 27, 28, 29, 32, 33, 34, of Township 4 South, Range 13 East, and Sections 3, 4, and 5 of Township 5 South, Range 13 East, all unsurveyed, on the Mt. Douglas 15-minute quadrangle.

Size: 4,662 hectares (11,520 acres).

Ownership: ~~Custer~~ GALLATIN National Forest.

Current Land Use: Upper reaches of the plateau are essentially utilized now for only limited recreation and grazing during the summer. Areas along the lower margin, however, have elsewhere been actively mined for chromite out of the lower part of the complex.

Description of Natural Values: The Stillwater Ultramafic Complex includes the largest deposits of chromite in the United States. At present, approximately eight percent of the chrome ore reserves of the United States occur within the complex. The Stillwater complex is a large differentiated tabular mass of Precambrian ultramafic and mafic igneous rocks that occur along the northern flank of the Beartooth Mountains in southwestern Montana.

Chromite and ultramafic rocks, in particular, are exceedingly rare in the interior of the United States. Without question, the Stillwater Complex is the most spectacular and, at the same time, the most generalized and instructive of these basic igneous intrusive bodies. The intrusion is a lopolith and exposes approximately 4,880 meters (16,000 feet) of layered rocks within the proposed landmark site. The intrusive mass continues beneath Paleozoic rocks to the north and the entire intrusion may be considerably thicker.

The Stillwater magma complex underwent gravity differentiation, so that heavy mineral elements in the magma settled toward the base, producing the prominent layering. The rhythmic layering is peculiar and suggests that the magma was in motion, that settling and movement produced the alternating bands of chromite-rich levels within the complex. The complex is exposed for a strike of approximately 48 kilometers (thirty miles) but is faulted at both ends. The proposed site is one where the structure appears to be moderately simple and the stratigraphic zonation from the floor up to the overlying Paleozoic rocks is moderately undistorted. Periodotite principally bronzite, harzburgite, and chromitite, occur in the lower part of the complex. These lower units are overlain by a principally bronzitite unit, and the upper thicker part of the complex that is made up principally of norite, gabbro, and anorthosite. The regular banding in persistant layered character of rocks in the complex is one of its most striking features.

Classic studies of the complex were made in traverses from the floor to the top of the exposed sequence in the general belt proposed as the landmark. The Stillwater complex must be one of the most famous igneous complexes in North America and certainly it is one of the most famous within the Central Rocky Mountain province.

Chromite was mined in the region, stimulated by World War I, in 1917 and 1918. Development continued but was sporadic through the 1920's and 1930's. Prior to World War II, the area was studied in detail by the U. S. Geological Survey, and in 1941, production was begun in three of the most favorable areas of the complex. Mining was stopped in 1943, by government order, when high-grade chrome ore again was imported. Chrome was again produced from the central part of the region from 1952 to approximately 1961, when again the mines were closed after completion of goals for government stockpiles.

Dangers to Integrity: Principal dangers to integrity of the region, now, is related to possible extensive mining of the chromite, platinum, gold, and other minerals, particularly from the lower part of the complex. Lower, more accessible areas probably will be affected before the proposed higher areas, like those of the landmark, however, so that danger in the foreseeable future seems slight.

Data Source: Published literature.

Other Knowledgeable Persons: Unknown.

Published References:


Foose, R. M., et. al., 1961. Structural Geology of the Beartooth Mountains, Montana and Wyoming: Geological Society of America Bulletin, Vol. 72, p. 1143-1172.

Hess, H. H., 1960. Stillwater Igneous Complex, Montana: Geological Society of America Memoir 80, 230 p.

Howland, A. L., et. al., 1949. Chromite Deposits of the Boulder River Area, Sweetgrass County, Montana: U. S. Geological Survey Bulletin 948C, p. 63-82.

Howland, A. L., et. al, 1954. Relations of Regional and Thermal Metamorphism Near the Base of the Stillwater Complex, Montana: Abstract, Geological Society of America Bulletin, Vol. 65, p. 1264-1265.

Jackson, E. D., 1961. Primary Textures and Mineral Associations in the Ultramafic Zone of the Stillwater Complex, Montana: U. S. Geological Society Professional Paper 358, 106 p.

Jackson, E. D., 1963. Stratigraphic and Lateral Variations of Chromite Compositions in the Stillwater Complex: Mineralogical Society of America Special Paper 1, p. 46-54.

Jones, W. R., et. al., 1960. Igneous and Tectonic Structures of the Stillwater Complex, Montana: U. S. Geological Survey Bulletin 1071H, p. 281-340.





Schafer, P. A., 1937. Chromite Deposits of Montana: Montana Bureau of Mines and Geology Memoir 18, 35 p.

Westgate, L. G., 1922. Deposits of Chromite in Stillwater and Sweetgrass Counties, Montana: U. S. Geological Survey Bulletin 725A, p. 67-84.


Priority: 1C

Publicity Sensitivity: None

Themes Represented:

I,B,I. Material-forming processes, igneous, a, textures, b, compositions, and c, structures.

II,B,3,a. Geologic time, Earth's history, Major landmarks in earth's history, Precambrian events.

Location of the Proposed Stillwater Ultramafic Complex Landmark



Stillwater Ultramafic Complex
Mt. Douglas 15' Quadrangle
1:62,500

United States Department of the Interior

OFFICE OF THE SECRETARY
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DENVER, COLORADO 80225-0007

TAKE PRIDE IN AMERICA

OCT 1 5 1991

ER 91/482

David P. Barber, Forest Supervisor
Gallatin National Forest
P.O. Box 130
Bozeman, Montana 59771

Dear Mr. Barber:

The Department of the Interior reviewed the supplement to the draft Environmental Impact Statement for the East Boulder Mine Project and concludes that our comments on the draft Environmental Impact Statement dated July 2, 1991, remain valid. Because Alternative 8 would result in fewer impacts to wildlife and wetlands than Alternative 7, we concur in the decision to designate Alternative 8 as the preferred alternative. 4-1

Sincerely,

Robert F. Stewart
Robert F. Stewart
Regional Environmental Officer

OCT 1 8 1991

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
FEDERAL BUILDING, US COURTHOUSE
301 S PARK
P O BOX 10023
HELENA MT 59626

TAKE PRIDE IN AMERICA

JUN 17 1991

M.19 Gallatin NF/Stillwater PGM Resources:
East Boulder Mine

June 14, 1991

Leonard L. Lucero, Acting Forest Supervisor
Gallatin National Forest
P. O. Box 130
Bozeman, MT 59771

Dear Mr. Lucero:

The purpose of this letter is to provide the Gallatin National Forest with the Fish and Wildlife Service's (Service) concurrence with the findings of the biological assessment for the Stillwater PGM Resources East Boulder Mine project on the Big Timber Ranger District, Sweet Grass County, Montana, pursuant to S402.12(j) of the 50 CFR. The biological assessment was received by the Service's Montana State Office on May 15, 1991.

The Service has reviewed this biological assessment and concurs with the Forest Service's determination that the proposed action to develop an underground platinum/palladium mine and associated milling facilities in the East Boulder River drainage is not likely to adversely affect the endangered bald eagle (Haliaeetus leucocephalus) or peregrine falcon (Falco peregrinus) or the threatened grizzly bear (Ursus arctos horribilis). In addition, the Service does not anticipate any incidental take of listed species as a result of the proposed project. Therefore, pursuant to S402.13 (a) of the 50 CFR, formal consultation is not required. This concurrence is based on information and assurances provided in the biological assessment and Draft Environmental Impact Statement (DEIS) that recommended conservation measures will be incorporated into the project design. These conservation measures include: 1) an education program for mine employees explaining threatened and endangered species concerns and sensitive areas; 2) revegetating disturbed areas near roads with species unpalatable to big game animals to reduce wildlife road kills and decrease the potential for bald eagles to forage along roads; 3) daily removal of roadside carrion along the East Boulder Road to reduce potential for collisions with bald eagles feeding on carcasses; 4) bussing employees to and from the mine to reduce traffic and wildlife collision potential on the East Boulder Road; 5) new power poles designed and installed to avoid bird electrocutions; 6) helicopter flights that will avoid bald eagle roosting and feeding areas and stay at least one mile away from the nearby peregrine falcon hack site; 7) the prohibition of firearms at all project areas during all project phases; 8) storage of garbage in bear-proof containers and a strict garbage control and removal program at all project facilities; and 9) keeping on-site food unavailable to bears. If, after public review and comment, the final project design is changed so as to have effects on threatened or endangered species other than those described in your May 1991 biological assessment, or if the conservation measures designed to minimize adverse impacts to listed species as described in 5-1

Page 2
Mr. Leonard L. Lucero
June 14, 1991

the May 1991 biological assessement and DEIS for this project are not fully implemented, a revised biological assessment will need to be prepared. The Service will then issue a letter of concurrence/non-concurrence on the revised biological assessment. 5-1

We appreciate your efforts to ensure the conservation of these threatened and endangered species as a part of your responsibilities under the Endangered Species Act, as amended.

Sincerely,

Donald Palawski
FOR Dale R. Harms
State Supervisor
Montana State Office

SDJ/sdj

cc: ARD, FWE, Denver, CO

Grizzly Bear Recovery Coordinator, Missoula, MT

Bill Timko, District Ranger, Gallatin National Forest, Big Timber Ranger District, P. O. Box A, Big Timber, MT 59011

Jeff Dawson, Woodward-Clyde Consultants, Stanford Place 3, Suite 1000, 4582 South Ulster Street Parkway, Denver, CO 80237

"Take Pride in America"

Montana Department of Fish, Wildlife & Parks

MEMORANDUM DATE: June 17, 1991

TO: Jo Stephen

FROM: John Mundinger JM

RE: East Boulder Mine Project DEIS/Biological Assessment

The DEIS generally addressed department concerns for fisheries. We request two clarifications in the final EIS:

1. The DEIS predicted that fishing pressure will increase as a result of this project. SWPGM has indicated to us a willingness to fund another creel survey to measure change in fishing pressure. We would prefer that this survey be specified as a mitigation measure in the preferred alternative. 6-1

2. Alternative 7 specifies that minimum historic flows will be maintained in the East Boulder River. The final EIS should indicate where the minimum flow will be measured. It is important that the measurements occur between the water diversion and the next tributary. 6-2

Thank you for considering our comments.

Montana Department of Fish, Wildlife & Parks

2300 Lake Elmo Drive
Billings, MT 59105
October 15, 1991

Ms. Jo Stephen
Project Coordinator
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

Dear Ms. Stephen:

Thank you for the opportunity to review the supplemental Draft Environmental Impact Statement addressing an alternative method of access to the East Boulder Project ore body. We certainly support reducing impacts to the aquatic resources of Brownlee Creek. The fish population in the East Boulder River above Brownlee Creek is dominated by purestrain Yellowstone cutthroat trout, a Montana Species of Special Concern. If drilling twin production adits (Alternative 8) would also reduce the volume of mine water produced, and therefore reduce impacts to the water quality of the East Boulder River, we would consider this option a positive step.

Please include again the following concerns as raised in response to the original DEIS: 7-1

1. The DEIS predicted that fishing pressure will increase as a result of this project. SWPGM has indicated to us a willingness to fund another creel survey to measure change in fishing pressure. We would prefer that this survey be specified as a mitigation measure in the preferred alternative.

2. Alternative 7 specifies that minimum historic flows will be maintained in the East Boulder River. The final EIS should indicate where the minimum flow will be measured.

It is important that the measurements occur between the water diversion and the next tributary. 7-1

Thank you for considering our comments.

Sincerely,

Roger Fliger
Regional Supervisor

RF:cs

C: Jim Darling
John Mundinger
Glenn Phillips

---

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
BILLINGS WATER RIGHTS FIELD OFFICE

STAN STEPHENS, GOVERNOR — 1537 AVENUE D - SUITE 105

STATE OF MONTANA

(406) 657 2105 — BILLINGS, MONTANA 59102

September 17, 1991

RECEIVED
OCT 01 1991
STATE LANDS

Ms. Jo Stephen
Project Coordinator
MT Dept. of State Lands
Capitol Station
Helena, MT 59620

Dear Ms. Stephen:

Upon review of the draft environmental impact statement for Stillwater PGM Resources East Boulder Mine Project and the subsequent supplement, I offer the following comments.

1. The draft EIS cites Stillwater PGM Resources' authority to divert surface water flows from the East Boulder River. Permit No. 43BJ-066426 has been granted to Stillwater PGM Resources with conditions that subject it to individual senior water right holders and certain Yellowstone River Basin Reservations including the Department of Fish, Wildlife and Parks' instream reservation. Stillwater PGM Resources could be asked to cease appropriating East Boulder River water when flows are insufficient to satisfy these demands. Permit 43BJ-066426 has been issued on a temporary basis and will expire November 30, 1993. If Stillwater PGM Resources requires appropriating water from the East Boulder River after this time, an application for beneficial water use permit will be required. 8-1

2. Stillwater PGM Resources has obtained a permit to appropriate up to 500 gallons per minute of water resulting from the adit construction (Permit No. 43BJ-75494). The use for this permit includes 100 gpm for industrial use, 100 gpm for pollution abatement and 300 gpm for sprinkler irrigation on 260 acres. The EIS and supplement discuss the low quality of mine water due to elevated nitrate levels. If adit water is applied to roads for dust suppression and 260 acres of land is sprinkle irrigated, could this create an additional problem with cumulative pollution sources? 8-2

Sincerely,

Tim Kuehn
Water Resource Specialist III

AN EQUAL OPPORTUNITY EMPLOYER

---

Cottonwood Resource Council, concerns with Draft EIS.

1) We feel that a 200 unit parking lot is excessive and would be detrimental to a successful busing program. We encourage the agencies to incorporate a busing program into the final EIS, and to downsize the parking lot accordingly. 9-1

2) If anything at all can improve the safety of the tailings impoundment dam, we think it should be incorporated into the EIS. A 2.5 yr. reduction in mine life may be nothing when compared to even a small gain in human safety considerations. We therefore encourage the agencies to adopt the 2:1 slope. 9-2 We also believe that in addition to a gentler slope, a terraced dam face may also facilitate reclamation success. We recommend this be included in the final operating plan. 9-3

CRC is also concerned about the potential reclamation success using only 2" of topsoil. 9-4

3) It appears from the DEIS that the technology is available to protect the pristine quality of the East Boulder River. We'd like to know if alternative 6a is technologically and economically feasible, and if so, what would such a facility look like. Detailed design plans for water treatment facilities should be provided for public review and comment. 9-5

What is the tradeoff between increased surface disturbance associated with a treatment facility, and maintaining the current water quality in the East Boulder? 9-6 There appears to be some health concerns associated with increased nitrate levels in the East Boulder water supply. 9-7 Perhaps the costs of a water treatment facility would be outweighed by the benefits to the public. 9-8

4) Where is the road going to be? DEIS appears to favor other alternatives than the existing road. CRC is concerned that the county may end up being forced to take the lead on this very troublesome issue. 9-9 If the existing road is the first choice for the project, have all the socioeconomic issues been dealt with? 9-10

5) CRC is concerned that should the parameters set by the IRA be met or exceeded by the ucmuliative impacts from the operating mine, other multiple use activities such as grazing permits, and wildlife habitat projects may be curtailed and eventually lost. 9-11

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The following are comments I would like to make concerning the proposed East Boulder platinum mine.

IN Chapter two (2.2) the EIS discusses the no action alternative. I would like some clarification. Are the agencies saying they have the ability to deny action? If not, why refer to it as an alternative and not just the baseline? Could you please explain more clearly the 1872 Mining Law's effects on this project. 10-1

On page 2-86 when addressing health and safety I would like to make sure there are emergency clean-up and rescue plans in place for an accidental spillage of chemicals, reagents, or materials during ~~transportation~~ to and from the mine site. Also will the company be responsible for the costs of training and mock practice exercises to make sure the best response to an emergency can be given? Will the company provide any specialized equipment that may be needed for emergency services? I realize some of this may be addressed in the HRIA, I feel these issues need to be identified here as they may or may not prevent an enviromental disaster. (keeping in mind the proximity of the EB Road and the EB River) I also have major concerns with these same issues as far as the mine site area is concerned. So far I've not seen these issues addressed adequately at all. 10-2

What does the law say concerning water degredation on the National Forest? What water rights does the public have if streams, lakes or aquafers are lost or destroyed during this project? What parts of the Clean Water Act are applicable in this case? What are the companies rights to water in this case? What are the historical rights in this case? How will they effect each other? Who has first rights? 10-3 In this draft EIS on page 4-54 the East Boulder low Flow is disscussed. I have major problems with the company being able to use the water from the East Boulder area up until historical minimum flows exist. Does this mean the aquatic life, ranchers and recreationalists get the 5cfs in the East Boulder that's low flow left over? 10-4 Where is this 5cfs level measured? What is the plan that will measure it? Will there be spring flow monitouring both in quality and kind? There needs to be, and there needs to be much more information. 10-5

On page 2-27 I find something very alarming. In this section it talks about intersecting surface and ground water and that "If permanent inflows be encountered, an application to appropriate the source would be filed with the Montana Department of Natural Resources and Conservation" I interperet this as saying if they intersect water they are going to file claim on it. This could be very damaging to the flow of the East Boulder River and the downstream water rights holders. 10-6

In Cottonwood Resource Council's first comments concerning this project and on other occasions we have expressed our concerns with the possibility of this being a Geo-thermal area and the need of study for Geo-thermal qualities on the East Boulder. This document contains nothing to that effect, and it should. 10-7

Hydrometrics Inc. is doing much of the hydrological study work. When they did the research for the Golden Sunlight Mine expansion project much of the work was later found out to be incorrect and inadequate. Should the agencies, company and general public rely entirely on the information they have found for this project? 10-8

As far as the water treatment alternatives are concerned as I've read the EIS, there's not near enough information to make a choice between the alternatives. One alternative I don't see is a tailings pond with a double liner and a leak detection system. 10-9

With the tailings pond issue, I would like to see more information as to what happens to the chemical reagents once they reach the pond? Do some of them break down over time? How much time? Which ones? Etc. 10-10

As far as a treatment plant is concerned there's not enough information to how one would work. Alternatives 6A and B have hazardous waste to deal with yet there's no mention of how that would be done. 10-11

Alternative C doesn't have that problem because the waste would be washed down the East Boulder River. This alternative is not acceptable. What about a Leachate collection system with a double liner? This would be our prefered alternative. 10-12

I'm concerned with the reclamation of water resources back to their natural riparian stream beds and what the diversion of the water from these areas will do to the environment. 10-13

The slope for the tailings pond must be a 2:1 slope, especially when you consider the proximity of the East Boulder River and that successful reclamation would be inpossible otherwise. 10-14 The proposed 2" of top soil seems intirely inadequate for reclamation, especially when you see what will be done on the Stillwater side. When dealing with the East Boulder River drainage we can not see how 2" of top soil in an area with very high historical winds and possible flooding can be any kind of true reclamation. We would like to see the type of reclamation that will leave the area with some type of good sustainable vegetative habitat somewhat as it is now, condusive to wildlife. Existing soils are at 6-30 inches. 10-15



Since all through this document information is always being used and pointed out from the similarities of this mine and the one in the Stillwater, I think it would be extremely helpful to have a detailed discription comparing the differences between the two projects, geographically, project designs, environmental impacts, etc. 10-16

It bothers me that the reclamation plan can be submitted later, after the EIS is already signed off on and the time for public input is over. This seems to leave reclamation standards in the hands of the company and somewhat the agencies. I realize that some reclamation decisions need to be made as problems or situations arise but there should be some way the public can be assured the area will be reclaimed to a high sustainable stability. 10-17

How long do we wait for reclamation to begin if there is an early mine shutdown? Should the public have input in the reclamation process? 10-18

I am very worried about the probable spread of noxious weeds, especially Leafy Spurge. I can see no way, given the amount of heavy traffic use the East Boulder is going to receive, due to this project, that especially Leafy Spurge will not become a major problem in the East Boulder Drainage and surrounding areas. With the huge amount or earth and earth moving equipment used in the construction and maintainance of the tailings pond I can not see how it can be helped. What also seems alarming is how the company will combat this problem. They'll not be able to use chemicals in many areas because of the proximity of the East Boulder River. A weed controll plan must be in place even before very much exploration goes on if they plan on a successful controll. 10-19

Please explain the added time frames for the supplement required for this document due to changing the adit openings. My first question though for the change is will this change add to the waste rock quantity and if so how much? Also where will the different adit be located? 10-20

I would like to know more about how the Forest Service IRA, recently completed for the Stillwater Complex, is being considered and incorporated into this planning process. 10-21 I would also like to know what Forest activities are either being scaled back or eliminated due to this project. Included in this document should be a list of alternative forest activities that will most likely be eliminated or ruled out because of this particular project. 10-22



One of the key things I and Cottonwood will be looking for is the reclamation bond and wether or mot it will be adequate. 10-23

This document should have some mention as to the life of this particular EIS as it appears this mine may be delayed because of mineral prices. How long is an EIS good for? When should it be reopened? If so what will the public input be? The public should have some say so in the EIS being reopened, within reason. The document should be reopened if there are significant changes in the environment of the area, if the project plans make any significant changes, if unforseen problems are later found out about the project plan, if a considerable amount of time has passed since the document was completed and if there is technology that could be used that would help reduce some of the environmental impacts. 10-24

I am consemed with the rare Sleeping Beauty plant that will be disturbed because of this project. I would like to see the Forest Service address this with a monitouring program before, during and after the life of this mine. 10-25

There is one very effective mitigation to many of the impacts that could be seen on the East Boulder due to transportation. That of course being busing. It is the only logical answer. It has not been suficiently addressed in this document. There must be a plan written into this final document that will address this issue. By using a bussing program the company in this situation will go a long ways in preventing negative environmental and social impacts. Our definition of busing is transporting the workers on *busses*. Why is there still talk about a 200 car parking lot if the company is talking about busing? We do not want to see 2 or 3 people carpooling in one car, we do not want to see 10-20 vans, we want to see all the workers on the buses for each shift. We realize there will be some car traffic to the site, and we realize there will be some truck traffic back and forth but by eliminating the huge wave of shift change traffic we can get at alot of the potential problems. Such a busing system needs to be in place from the very begining for it to work. I would think it would help the traffic flow to and from the site for the company as well, given the area and road conditions. 10-26

Also within this document needs to be more information concerning the transportation using large trucks and machinery. Marbe a little more detail concerning a staging area in or around Big Timber. 10-27



When reading this document I find I become very frustrated when trying to comment on the various issues and alternatives. In all most all cases there is not enough information, back ground or planning to make preferences. I feel that if the public is expected to comment on alternatives it must be given more information. Many times the document makes reference to "the company must submitt this plan, or the company will do this..." but there are no specifics for the public to examine. An example would be the water monitouring or the busing issue. I realize that the draft EIS needs to be flexable at this point, but the next step in the process is the final EIS with the decisions being made and the public falls out of the process unless they appeal. 10-28

I have written this letter mostly in the first person, but my comments represent that of myself, my husband Pat and The Cottonwood Resource Council.

Sincerely,

Jean Clark CRC/NPRC Board Rep. Pat Clark, CRC Secretary

Jean Clark, Pat Clark and Cottonwood Resource Council

Jo Stephen
Montana Dept. of State Lands
Capitol Station
Helena, Mont. 59620

Dear Jo,
On behalf of Cottonwood Resource Council, I would like to ask you a few questions (and make a few comments) about the East Boulder draft EIS.

The wastewater issue seems to be unresolved. State regs require you to look at alternatives to the Company's proposal for a non-degradation permit. It looks as though Alternative 6a is the only instance in which the Company might not need a non-degradation exemption. If this is the case, what does alt. 6a look like? Granted, 6a is potentially very expensive, and could result in considerable negative impacts to the area, however, we hope that the Agencies will keep in mind what the true cost of degrading the East Boulder's pristine water quality might be. **11-1**

Spring-flow monitoring is included on the Stillwater side. Why is it absent in this EIS? **11-2**

What happens if the TBM intercepts an aquifer such as Brownlee Creek, and as a result the Company files for water rights which used to be downstream rights? **11-3**

As far as reclamation goes, will you stick to your guns on the 2/1 slope? And will you try to improve on the proposed 2" of topsoil? Reclamation is going to be very difficult, if not impossible, for this facility. (2-82) The Forest Service suggests that proposed revegetation is doubtful. We hope you will stand your ground on the various issues surrounding reclamation. **11-4**

We hope that you will not grant an operating permit until a busing plan is in place, and the parking lot has been downsized considerably. Why have you based the required parking lot size on car-pooling statistics??! **11-5**

We hope that your agency will insist on some form of flexibility in the permit, should the Company wait several years to start operations. The Company should be made to adhere to any new environmental regulations that may have come about from the time the permit is granted to the time that operations commence. **11-6**

We would like the Forest Service to list activities (2-87, parameters of the IRA exceeded by mine) that will be displaced from the IRA proposed activities list because of the existence of the East Boulder Mine. The public ought to know what types of impacts a mine can have on nearby multiple-use activities. **11-7**

While your agency cannot deny "Reasonable and Logical Mining", is it not reasonable to take every measure possible to protect both the environment and the public safety? Your agency has a right as well as a responsibility to at least hold the Company to your preferred alternatives. **11-8**

I would like to extend our appreciation to you for your willingness to listen to concerns from outside your agency. You have made extra efforts to involve the public in this process, and for this we are grateful.

Sincerely,

Dude Tyler, Chairman
Cottonwood Resource Council
HC 89 Box 4306
Big Timber, Mt. 59011

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Jo Stephen
Montana Department of State Lands
Capitol Station
Helena, Mt. 59620

Sherm Sollid
Gallatin National Forest
P.O. Box 130
Federal Building
Bozeman, Mt. 59771

Dear Jo and Sherm,
Thank you both for the meeting we had August 17 in Big Timber. I'm sending you some of the notes I took, including CRC's interpretation of changes to be made in the Final EIS. If I am off target on any of these, please let me know.

Water Quality:

Specific details of the various water treatment facilities (alternatives 6 - a,b, and c) will be included in the FEIS. Agencies will rewrite the sections covering water treatment plants, including a description of both the impacts of generation and the disposal of solid waste from the plant. Sherm will notify us as per details of the water treatment plants prior to release of the FEIS. **12-1**

All potential sources of degradation except the septic system will be treated by the proposed treatment plant. We understand that nitrates from septic systems are a Pandora's Box for all of us, however we suggest that the agencies take a hard look at the potential, cumulative impacts to the Boulder River, due to not only this mine, but also additional mines, summer home developments, etc. This may well be an issue that will return to haunt us all. **12-2**

Sherm will talk with Tom Reid about the possibility of separating blasting drainage water (containing nitrates) from other adit drainage water. **12-3**

There are no alternatives to using nitrates in blasting materials. **12-4**

The agencies are looking at testing the rock in the adit location for acid generating potential. **12-5** The Company will stop at known, mapped faults, and will drill ahead with test holes to look for water. This is stipulated in the exploration permit. CRC suggests that this same requirement be extended to the operating permit. **12-6**

Water rights filed on by the Company are subject to all other existing rights. **12-7**

FEIS will include a map - with a legend - showing all water monitoring sites. **12-8**

Contingency plans will be in place for spills and other emergencies, on both county and FS roads. **12-9**

Tailings pond/reclamation

The tailings impoundment will have a leak detection system, as well as ground water monitoring wells. These will be explained in detail in the FEIS. **12-10**

The agencies will require a 2/1 slope on the dam. The face will be reclaimed by interspersing 150 foot patches of soil and trees among the rock face. This will create at least a 50% area of revegetation to add to the stability of the dam face. Reclamation on the dam face will be done at the end of the mine life. The amount of soil available for reclamation is one to two feet. **12-11**

Dewatering of the tailings pond will be required, and the plan for this will be shown in detail in the FEIS. **12-12**

Sherm will investigate the feasibility of the Company's returning some tailings to one of the two adits. **12-13**

Road/Transportation

FEIS will include a busing plan. Agencies will require a target number of people per vehicle, as well as redesigning the parking lot to reflect the decrease in vehicle numbers due to the busing. CRC understands that "bus" means large, passenger - type buses, rather than vans, mini-buses, etc. **12-14**

CRC supports the inclusion of the Company's intended route to the mine as a mitigation measure in the FEIS. The road will probably be paved, however the FEIS will have more specifics. **12-15**

CRC assumes that any major changes to the operating plan, as well as a significant lapse in time from the granting of the operating permit to actual operation (we suggest 5 years), should trigger a reopening of the EIS, and that the agencies should include language to this effect in the FEIS. **12-16**

I hope to hear from you before the FEIS hits the streets. On behalf of CRC, I thank you both for your willingness to listen to us, and for the extra energy you have devoted to the EIS in order to answer our questions and concerns.

Sincerely,

Dude Tyler, Chair
Cottonwood Resource Council
HC 89 Box 4306
Big Timber, Mt. 59011

# Montana Wilderness Association

June 25, 1991

Mr. Sherm Sollid
Geologist
Gallatin National Forest
P.O. Box 130
Bozeman, MT 59771

Dear Sherm,

I write on behalf of the Montana Wilderness Association to comment on the proposed East Boulder Mine Project. We are greatly concerned about the impacts this mine will have on the Absaroka Beartooth Wilderness.

The comments that follow represent the views of our organization as a whole. More specific comments will come from our members who use, and know the area.

Although the DEIS identifies impacts to wildlife, recreation, and wilderness, it is unclear to us how adverse impacts will be mitigated. Furthermore it is unclear to us which mitigation measures will be part of the operating permit. 13-1

Increasing mineral development around the perimeter of the Absaroka Beartooth Wilderness is of great concern to us. Although each project has its list of impacts we can find no analysis of cumulative impacts on the wilderness area and its inhabitants. We are concerned that wildlife populations dependent on the integrity of the Absaroka Beartooth Wilderness are being impacted more than is evident by a project by project analysis. In addition, we believe that the quality of a wilderness experience for recreationists will deteriorate as a direct result of mining activity on the boundary of the wilderness. 13-2

We urge the Forest Service to consider the cumulative impacts of mining projects surrounding the wilderness in any further analysis of the East Boulder Mine Project.

Sincerely,

Louise Bruce

Louise Bruce
Vice President

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# Northern Plains Resource Council

July 10, 1991

Jo Stephen
Department of State Lands
Capitol Station
Helena, MT 59620

Sherm Sollid
Gallatin National Forest
PO Box 130
Bozeman, MT 59771

Dear Ms. Stephen and Mr. Sollid:

Please consider the following comments for the record of the Northern Plains Resource Council on the Draft Environmental Impact Statement for the proposed SPGMR East Boulder platinum/palladium mine. NPRC is a Montana grassroots citizens organization with 6000 members and supporters. NPRC, and its local affiliate in Sweet Grass county, the Cottonwood Resource Council, have been actively involved in the permit process for the East Boulder mine since the early stages of the proposal. Please consider these comments for the record on the DEIS.

NPRC is concerned about the impacts this proposal will have on surface and groundwater resources. In general, the DEIS leaves many questions and concerns unaddressed. Specifically, our concerns lie in the following areas.

**WATER**

Sec.2.3.6.1. p.2-27 How will it be determined when SPGMR should apply to DNRC to appropriate permanent water inflows encountered during mining? How will this impact water uses on springs, creeks or the East Boulder where existing downstream water rights are held? 14-1

What will be the impact on these water rights?

What will the impacts be; on water rights, and river ecology, of maintaining only 5 cfs, as described on p.4-54, during entire life of project, and throughout an entire year? 14-2

In Sec.4.3.1. it is stated that potential impacts of tunnel boring machine to surface water resources is considered low. What evidence was used to make this determination?

Will Camp Lake or Canyon Creek be affected by TBM? DEIS states in Sec.3.2.1. (p.3-6) that it is unknown whether these "have a direct hydrological connection..." to proposed tunnel areas. When will it be known if they are? Will it be included in the FEIS? We believe it should be included in the FEIS for public review. 14-3

Will it be required that the tunnel be rerouted to avoid fracture zones?

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Sec.3.3.2. What precautions will be taken at the fault zones to avoid permanent impacts to surface water resources? 14-3

Sec.2.3.6.2. Will the quality of mine discharge water be tested between sediment pond and percolation pond? What will the quality of this water be? Such testing should be part of the monitoring plan. 14-4

Sec.2.4.4. How was it determined that 14 years of post-mine life treatment will be needed for mine water discharge? Who will pay for operation of treatment systems after the mine closes? Will this cost be included in SPGMR's bond? What if longer periods of treatment are needed, who will pay to operate treatment systems? SPGMR should have the responsibility for all these costs, and should post bonds to cover them. 14-5

2.4.4.1. We are concerned that very little detail is provided about the physical layout of proposed water treatment system alternatives, location of the system, and the impacts of such a facility on the area. The DEIS provides no such information about the proposed water treatment systems. For instance, on p.2-75 the DEIS states that the "...information is preliminary with regard to design requirements..." and that "More information on feed stream parameters.....would need to be collected..." The DEIS goes on to state that the water treatment alternatives "...in various combinations could probably be used..." to remove pollutants from mine water. SPGMR should provide additional information on water treatment strategies at the mine.

Is this all the information the agencies will use to decide on final water treatment strategies for the mine? When will this additional information be collected? Will the public be given a chance to review this information? Will it be distributed to those who received a DEIS? We find it unacceptable that the agencies and the public are forced to make decisions and comments about this aspect of the mine proposal when so little information about the facilities and their impacts is available. 14-6

Sec.4.2.6. Will more details about water treatment alternatives be provided before the FEIS is released? What will the impacts of constructing the water treatment facilities be? When will design and construction plans for the alternatives be analyzed? How can total impacts of project be assessed without this information ?

Impacts from the location of the treatment facility should be analyzed before the FEIS is released, and be made available for public comment.

Sec.4.2.7. When will plans to "channel drainage to the percolation ponds" and to "maintain the ponds" be developed? How will it be assured that this will take place? Will SPGMR bond include this expense? How long will maintenance be required for 14-7

the percolation ponds? This plan, and answers to these questions, must be answered before the FEIS is approved. 14-7

Sec. 2.4.4.1. What are likely impacts of the proposal to dispose of solid waste generated by the water treatment process in the tailings pond? Where will disposal take place? What will be the make-up of the waste? Will it be considered hazardous waste, subject to Resource Conservation and Recovery Act regulations? Will the agencies permit the mine with these questions unanswered? When will the public have an opportunity to review this information about waste generated by the water treatment systems, and the impacts of disposal? 14-8

This information should be available to the public, and impacts described, before the FEIS is released.

What would be the contents of 320 cubic yards of dry solid per year from reverse osmosis system? If it contains hazardous waste, where would it be disposed of? If disposed in the tailings pond, what will be the impact on ground water as the tailings pond leaks? It doesn't make sense to treat mine discharge water, then put the waste in the tailings pond where it will leak back into the ground water anyway. A disposal plan must be developed for public review before release of the FEIS.

p 2-76 Why is forced evaporation considered if it is not a proven means of nitrate reduction? 14-9

p 2-78 How will the disposal of 700 cubic yards of dry salt solids per year in tailings facility effect the efforts to reclaim the tailings impoundment? What will be the impact on ground water quality as the tailings pond leaks? 14-10

Sec.2.4.4.2. Does "suspended solids removal" do anything to treat the nitrates problem? 14-11

p 4-27 What will be the per year volume of leachate from the tailings pond? Will this leachate be monitored for impacts to water quality? 14-12

Is SPGMR seeking an exemption to Montana non-degradation policy to allow operation of the tailing facility in the manner described on p.4-27, where "seepage of tailing liquid into the groundwater would result in minor degradation..."?

What is the "contingency plan," alluded to on pp. 4-30 and 4-31, to handle excess nitrates or other compounds in groundwater from the septic system? Will this water be treated in the water treatment system? A "for instance" example of one treatment method is provided, however, specific plans should be detailed by SPGMR in a timely manner so it can be reviewed publicly. 14-13

When will this contingency plan be developed? When will public review of this plan take place?

Sec.5.1. Will seepage from the impoundment be subjected to the water treatment facility? Will it be collected and monitored? As described in Sec.2.5.3., p.2-82, seepage collection should be required. 14-14

p.2-80 Will separation of mine discharge waters be considered as an alternative, to help reduce the volume of mine discharge water that must be treated? This should be considered. 14-15

Sec.2.5.3. states that the septic system "may" introduce nitrates and other contaminants into groundwater. The septic system "could" introduce contaminants into groundwater and the East Boulder River (p.4-14). When will it be known if this will occur? Will the occurrence of contaminants from the septic system be considered in the impacts analysis? This analysis should be done before the FEIS is released. 14-16

What is the proposed program for monitoring waste rock for acid mine drainage (AMD) potential? If acid-forming rock is encountered, what will be the plan to properly dispose of it? 14-17

Sec.2.5.7. If waste rock is found that generates AMD, how will this affect the water treatment facility design? 14-18

p.2-15 What alternatives to the ammonium nitrate fuel oil mixture can be used for blasting to reduce nitrates formation, and subsequent water treatment needed? 14-19

The water treatment plant should be built for worst case scenario, i.e., if all four sources of pollution: tailing ponds leachate, percolation pond, sewage system, and adit discharge, require treatment.

The information provided in the DEIS regarding water treatment facilities and impacts to water resources is incomplete and leaves several questions unanswered. There appears to be four sources of water contamination that "could" or "may" violate the Montana non-degradation standard. These are the adit discharge water, percolation pond water, tailings pond leachate, and the septic system. It is unclear which of these in fact will violate the non-degradation standard. When will this be known? 14-20

If in fact all four sources, or a combination of them, will violate non-degradation standards, will contaminants from each be treated in the water treatment systems being proposed in the DEIS? Will water from the tailings pond leachate? From the septic system? From the percolation ponds? Are the water treatment alternatives designed to handle waste water from all of these sources? Plans for water treatment so far are conceptual, and are not detailed enough to answer the above questions. We believe that these answers must be provided before the NEPA analysis can continue to the stage of a FEIS.

**RECLAMATION**

NPRC shares the agencies reservations about the success of reclamation as proposed by SPGMR. We strongly support alternative 3, which would require a 2:1 slope for the tailings impoundment. Our concerns center around comments in the DEIS such as "...it is anticipated that the proposed reclamation of the tailing surface has a low probability of success," (p.4-38). We question the likely success of reclamation given that a large degree of settling will occur on the tailings surface, and that only two inches of topsoil are available for reclamation. 14-21

It is stated on p.4-38 that designs for tailings impoundment are "conceptual," and therefore evaluation of "stability, reclamation, and other parameters are therefore conceptual as well." When will "actual" plans and evaluations for tailings pond design, reclamation etc. be revealed, and allowed a public review? Will these plans be included in the FEIS, or made available for public review beforehand? Will the agencies permit the mine based on "conceptual" designs for the tailings impoundment, and reclamation? 14-22

This information should be provided prior to FEIS release, and include specific plans explaining the design and reclamation of the tailings impoundment.

p.2-58 Which method will be used to de-water the tailings pond? Will de-watering be required at all? If it is done, how will it affect reclamation? 14-23

Sec.2.3.20.4. Will SPGMR be bonded for maintenance of the percolation ponds? If so, how long will the bond be held? If not, how will post-mine maintenance be paid for, and who will do it? DEIS states on p.5-56 that "maintenance for the ponds would be the responsibility of SPGMR." Will this be a stipulation of the SPGMR operating permit? SPGMR's permit should require this. 14-24

Sec.2.4.1.3. With the new twin adit proposal, would the 3:1 slope be feasible if the excess tailings were placed in the twin adit at the end of the project? What volume of tailing could the twin adit hold if filled? 14-25

Please describe the reclamation plan for Placer Basin. 14-26

Sec.3.12 How will the tailings impoundment be designed to comply with visual quality objectives after closure? The tailings pond does not meet the partial retention visual quality objective (p.4-71,72). Will the mitigation described in Sec.4.12.7. enable the tailings impoundment to meet the partial retention VQO? 14-27

Why does the land area west of Camp Lake have a visual quality classification of "M" (modification), as noted in Fig.3.12-1? 14-28

What will be the impact of tailings pond settlement of up to two feet (described on p.2-59) on reclamation success and pond stability? We share agency concern over success of reclamation, and support the development of reclamation alternatives that will result in reclamation success. 14-29

Embankment reclamation was not considered by SPGMR. Will this be an alternative developed for reclamation? We believe that successful reclamation plans approved for this project should include the revegetation of the tailings embankment. 14-30

Is two inches of topsoil all that is available for tailings surface reclamation, as indicated on p.2-59? Can revegetation success be guaranteed with two inches of topsoil? What other alternatives exist that may yield more topsoil for revegetation? Will reclamation with two inches of topsoil allow for restoration to pre-mining land use objectives? 14-31

Should the mine experience a shut down, how long will this condition be allowed to exist before reclamation is required to start? 14-32

**WILDLIFE**

Impacts to grizzly and black bear populations should be minimized, although the black bear habitat in the permit area will "be eliminated," (p.4-44). NPRC supports implementation of a strict refuse control and collection program, so bears will not be attracted to the site. Will such a refuse control program be developed before the permit is issued, and will compliance with this program be a stipulation in the mine's operating permit? 14-33

Will the tailings pond area be fenced to keep out wildlife? 14-34

**EMERGENCY SPILL PLAN**

Sec.2.5.15. An emergency response plan should be developed for spills or leaks of hazardous toxic substances along access route from Big Timber as well as on site. Will the proposed plan be expanded to include transportation from Big Timber? 14-35

Sec.2.5.10. Will the company be bonded for the contingency plan to address impacts to surface water and mitigation if the tailing impoundment breaks? Will this plan be included in FEIS? Will it be available for public review? This plan should made available for public review before the FEIS. 14-36

**ROAD / BUSING**

Sec.2.5.6. Will the agencies require SPGMR to submit and have approved a specific busing plan before the FEIS is approved? 14-37

Will a mandatory busing plan become a condition in the mine's operating permit? NPRC believes a mandatory busing plan should be required, made available for public comment, and included as stipulations in the mine operating permit. 14-37

Will consolidation of materials and supplies take place at a staging area to reduce traffic to mine? 14-38

On what assumptions is the need for a 200 car parking lot based? Will this lot be scaled down? If mandatory busing is implemented, will this size lot be needed? 14-39

As noted on p.4-65, maintenance of a gravel road is more expensive than a paved road, which is listed as an option for FS 205. Will not implementing mandatory busing reduce traffic to such a level that paving may not be necessary, and where maintenance cost on the gravel road are reduced? Will this be looked at as an alternative in the FEIS? 14-40

When will specifics for the upgrade of FS 205 be developed?

NPRC believes SPGMR should not be granted a permit until the road access issue is resolved. Will the permit be granted before the road access question is resolved? 14-41

How will 298 be upgraded between 8-mile bridge and McLeod? Who will pay for it? Will it be posted for load limit in the interim? 14-42

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NPRC appreciates the opportunity to comment on this draft Environmental Impact Statement on the East Boulder Project, and look forward to participating in the public review process as this project develops.

Sincerely,

Paul Hawks

Paul Hawks
Chairman

# Northern Plains Resource Council

October 15, 1991

Jo Stephen
Department of State Lands
Capitol Station
Helena, MT 59620

Sherm Sollid
Gallatin National Forest
PO Box 13D
Bozeman, MT 59771

Dear Ms. Stephen and Mr. Sollid:

Please consider the following additional comments for the record of the Northern Plains Resource Council and the Cottonwood Resource Council on the Draft Environmental Impact Statement for the proposed SPGMR East Boulder platinum/ palladium mine. These comments are meant to augment the comments submitted by NPRC to the agencies on July 10, 1991.

NPRC is a Montana grassroots citizens organization with 6000 members and supporters. NPRC, and its local affiliate in Sweet Grass county, the Cottonwood Resource Council, have been actively involved in the permit process for the East Boulder mine since the early stages of the proposal. Please consider these comments for the record on the DEIS.

NPRC is concerned about the impacts this proposal will have on surface and groundwater resources. In general, the DEIS leaves many questions and concerns unaddressed. Specifically, our concerns are described on the following pages. Thank you for this opportunity to comment on this proposal.

Sincerely,

Jean Clark
Cottonwood Resource Council

Paul Hawks
NPRC Chair

419 Stapleton Building Billings, MT 59101 (406) 248-1154

NPRC and CRC repeat the criticism made in our previous comments on the Draft EIS about the thoroughness of the information provided and the analyses given in the DEIS. Many statements are made without supporting information provided, and plans are proposed without describing the details or impacts of these plans. The agencies should not accept the unsupported conclusion of SPGMR. Specific examples of this will follow. 15-1

The DEIS provides an incomplete description of several alternatives. The plans for road access to the mine, the power line route, and the different water treatment facilities are incomplete, and must be more fully described. The impacts from these alternatives cannot be assessed until the plans for each option are described. A full description of each alternative, and the impacts of each, should be revealed for public review before the Final EIS is completed. 15-2

Water Impacts

The DEIS addresses alternative water treatment facilities to handle mine waste water that would violate Montana's non-degradation policy. NPRC believes the agencies should develop a range of alternatives that do not allow degradation in the East Boulder River. This would fulfill the stated goals of the National Environmental Policy Act (NEPA) - to develop alternatives which do not degrade the existing environment. 15-3

Also, the DEIS should describe in detail the expected impacts from the degradation that would occur under each of the alternatives presently described in the DEIS, as well as impacts from additional alternatives.. This discussion should include impacts to water quality and aquatic life. What will be the impact from an increase in contaminants in the East Boulder above ambient levels but below drinking water standards? 15-4 An additional alternative NPRC would like to have considered is the development of an artificial wetlands system to treat mine discharge water. 15-5

Water Monitoring. Critical to determining levels of degradation is adequate baseline data and monitoring systems. NPRC questions whether the water quality data is sufficient to determine ambient conditions or determine compliance with numeric or non-degradation standards. Has the water quality of the East Boulder been accurately characterized? Will the monitoring capabilities of SPGMR be able to accurately track levels of degradation that are above ambient levels, but should not be above drinking water standards? 15-6

A water monitoring program at the East Boulder site must be site specific, and described in a NEPA document subject to public review. The DEIS (p.2-47) notes that the SPGMR monitoring program will "...closely resemble the monitoring program now in place at the Stillwater Mine." This provides no basis for evaluation of the program. NPRC suggests monitoring be done monthly, not quarterly, and that biological monitoring of benthic organisms above and below the mine on the East Boulder and Brownlee Creek be done at least twice a year. 15-7

NPRC is also concerned that the water flow data for the East Boulder is insufficient, since it appears that only 4 years of records are available. Can the estimates of degradation in the East Boulder be accurate if the flow data for the East Boulder is in question? 15-8

Monitoring wells should be designed to allow evaluation of vertical flow components through the aquifer. 15-9

Baseline water monitoring should continue at existing sites until the mine begins operation. New sites should be added and more baseline gathered in the interim until the mine begins operation. 15-10

The Boulder River should be monitored as well as the East Boulder. Cumulative impacts on the Main Boulder will be more easily tracked if baseline and ongoing monitoring is done. 15-11

Cumulative impacts of allowing degradation to the East Boulder must also be described. This should include impacts of this degradation source on the Boulder River, and consider all other likely development that will impact these streams. 15-12

Incomplete Data. The estimate of water quality in mine water discharge from the East Boulder is based on one sample taken from the Stillwater Mine. NPRC questions the validity of this assumption. More samples should be taken. 15-13

Similar questionable assumptions are made elsewhere. The DEIS (p.2-30) states that the tailing pond water at the East Boulder has been "... assumed to be similar in quality to the Stillwater tailing water." Elsewhere, the DEIS (p.2-30) states that "...SPGMR expects the mine discharge water to meet all drinking water standards." Sec. 2.4.4. "indicates" that mine discharge water mixing with ground and surface water would "...likely not exceed drinking water standards or water quality criteria." All information to back up these, and other similar claims made in the DEIS, must be provided in the EIS. Again, the agencies should not accept these unsupported assumptions by SPGMR. 15-14

Alternative 7 describes several "contingency" plans which disturbingly contain no detail on how they will work or the impacts associated with them. The details of these plans must be described in the NEPA process in the EIS. Several examples include: 15-15

Bussing plan: The DEIS (Sec. 4.10.7.) notes only that a bussing plan would be submitted to the agencies "...prior to implementation." NPRC finds this unacceptable. A bussing plan must be included in the EIS and subject to public review. The size of the parking lot should then be reduced.

Impoundment stability: Sec.2.5.10. notes that a contingency plan for tailing impoundment failure "...must be developed." NPRC urges that this plan be developed and included in the final EIS. Soil available for revegetation and reclamation must be specified in the EIS. 15-15

A contingency plan for treating hazardous waste rock must be specified in the EIS. The Draft EIS (Sec.4.2.2.) notes that "..lithologies...which create conditions for acid mine drainage could be encountered during mining." What will happen then? A contingency plan to deal with acid generating rock must be described in the EIS.

Water Quality. What will be the makeup of the runoff from the permanent waste rock storage piles? How will this be monitored, and treated if the runoff contains contaminants? 15-16

NPRC strongly urges that the bonds for the mine be determined before the EIS is final, and that the bonds are included in the EIS for public review. Bonds must adequately address all potential impacts to water quality and quantity. Additionally, the EIS must provide the specific plans for "perpetual" pond and diversion facility maintenance, and water treatment. It is unacceptable to leave these plans unresolved until after the EIS is final. Bonds should include the cost of the maintenance and operation of these "perpetual" facilities. 15-17

Discussion of cumulative impacts should address cumulative effects of all projected activities at the mine site on water quality and aquatic life, including sediments from roads, mine and adit sites and other disturbed areas. 15-18

Water Flows. SPGMR should not be allowed to reduce the East Boulder water flow to historic levels on a regular basis. The DEIS only maintains that historic low flow levels be preserved. However, there is no discussion of frequency of draw down to low flow levels. Can SPGMR take all but low flows out of the East Boulder every year? If this is not the case, it should be explicitly stated in the EIS. NPRC questions where the water flows will be monitored, and how it will be determined whether the flows are kept at no less than historic low flow levels? 15-19

Tailings pond. Will the design capacity of the tailings pond be sufficient to contain a 100 year and a 50 year 15-20

precipitation event? What is the contingency plan for overflow emergencies? Where will the overflow be directed?
What is the plan for monitoring the tailings pond water? 15-20

A plan for stabilization, reclamation, continued monitoring and maintenance needs to be developed for when there is a temporary shut down of the mine. Such a plan must be included in the final EIS, and the mine operating permit. 15-21

All contingency plans, mitigation measures, and special conditions identified in the final EIS must be written into the operating permit the mine eventually receives. 15-22

**COMMENTS OF CRC AND NPRC IN SUPPORT OF A PREFERRED ALTERNATIVE THAT WOULD NOT VIOLATE MONTANA'S NONDEGRADATION POLICY**

The Northern Plains Resource Council (NPRC) submits the following comments on the draft EIS for the East Boulder Mine Project in conjunction with the Cottonwood Resource Council (CRC), the local NPRC affiliate in Sweet Grass County. The following comments specifically address issues related to compliance with the Montana Water Quality Act's policy of nondegradation of pristine waters. In addition, the following comments include an assessment of how compliance with Montana's water nondegradation policy relates to other state and federal laws such as the Federal Clean Water Act and the Montana Metal Mine Reclamation Act.

First, NPRC disagrees with the statement in section 2.1 (paragraph 1) that "...rules to prevent degradation of and surface waters...require consideration of alternatives which would result in no water degradation or *at least reduce the amount of degradation*." [Emphasis added.] NPRC believes that this statement is a misinterpretation of Montana's nondegradation policy. Section 75-5-303, MCA states that "The board [of Health] shall require...any...new...or...increased source of pollution to high quality waters...to provide the degree of waste treatment necessary to maintain that existing high water quality." In NPRC's opinion, this section of Montana's water nondegradation policy prohibits any consideration of alternatives that would "at least reduce the amount of degradation," because the East Boulder Mine Project would in fact be a "new source" of pollution not eligible for the nondegradation exemption provided for in Section (1) of the nondegradation policy. NPRC believes that only existing sources of pollution are eligible for the nondegradation exemption provided for in Section 75-5-303 (1), MCA. Montana's nondegradation policy prohibits state or federal agencies---in this case DSL or the Forest Service---from issuing permits to new or expanded pollution sources which would result in degradation of high quality waters. All alternatives in the draft EIS---except for Alternative 6(A)---state that they would violate nondegradation standard. Therefore, the permitting of the East Boulder Mine Project under any alternative outlined in this draft EIS---with the possible exception of Alternative 6(A)---would be illegal under Montana's nondegradation policy. 15-23

NPRC also disagrees with the following sentence (in section 2.1, paragraph 1) in the draft EIS stating that, "This EIS fulfills DHES's responsibilities to assess the required alternatives [to degradation]." The rules implementing the state's policy of nondegradation of pristine water prohibit both the MDHES Water Quality Bureau and the Montana Department of State Lands (DSL) from considering alternatives in the Draft EIS that would allow a violation of the state's water nondegradation policy. Alternative 6 (A) is the only option in the Draft EIS that would require treatment of discharges to a degree that *may* succeed in preventing degradation of the East Boulder River's high quality waters. However, it is questionable whether even Alternative 6(A) will meet the nondegradation standard, because the projected pollution levels---although ostensibly not exceeding ambient background levels---rest on inadequate data and unsubstantiated assumptions. Additionally, the WQB has violated the procedures outlined in the state's nondegradation rules that govern how petitions for exemptions to the nondegradation policy should be filed. 15-24

**MONTANA DEPARTMENT OF HEALTH & ENVIRONMENTAL SCIENCES WATER QUALITY BUREAU HAS VIOLATED MONTANA'S NONDEGRADATION RULES (Title 16, Chapter 20 - Water Quality, Sub-Chapter 7, ARM)**

The Water Quality Bureau (WQB) of the Montana Department of Health & Environmental Sciences (MDHES) has consistently ignored its own water quality nondegradation rules that require the agency to treat nondegradation petitions as **amendments** to water discharge permits that are already issued not allowing degradation.

**Violation of 16.20.704 (1), Administrative Rules of Montana**

The WQB has failed to comply by its own nondegradation rules by allowing Stillwater PGM to petition the Board of Health for a nondegradation exemption before issuance of necessary water discharge permits. Section 16.20.704 (1), ARM, states that

> If any condition which has been imposed on a permit requires the permittee to maintain the quality of receiving waters at levels better than the applicable water quality standards, the permittee may petition the board for a **permit amendment** as provided for in this section. Such a petition must be filed within 30 days **after the issuance** of the permit. The procedures for this sub-chapter are also available to operators of pollution sources not subject to permit requirements. [Emphasis added.]

It would be inconsistent with this rule to allow the East Boulder Project to be permitted under any of the alternatives allowing degradation and therefore require a nondegradation exemption. Stillwater PGM should be allowed to file a nondegradation petition only as an amendment to a discharge permit that has already been issued, and that has "require[d] the permittee to maintain the quality of receiving waters at levels better than the applicable water quality standards." Alternative 6 (A) is the only alternative in the draft EIS that may meet this requirement. All other options state in writing that they will violate Montana's nondegradation policy. MDHES should require the East Boulder Project to be permitted only under alternative 6 (A), and then only if the company can affirmatively demonstrate, and the agencies can confirm, that nondegradation will not occur. If the company believes this alternative is too burdensome, it can then petition the Board of Health for nondegradation exemption, i.e., a permit **amendment**, "within 30 days <u>after</u> the issuance of the permit." 15-25

The WQB argues that it exempts hard rock mines from having to obtain groundwater discharge permits because it demands that the company meet the same requirements through stipulations included in the mine permit under the Metal Mine Reclamation Act. The last sentence in section 16.20.704 (1), ARM, states that "The procedures of this subchapter are also available to operators of pollution sources not subject to permit requirements." So while "permit" is defined in the nondegradation rules as being either a surface or groundwater permit, this last sentence appears to extend this same procedure for mines seeking nondegradation exemptions for discharges to groundwater as for those seeking exemptions for discharges to surface water. In other words, mines can seek this exemption through an amendment to its mine permit---which the WQB allows to be substituted for a groundwater permit. However, such a mine permit must be issued first under conditions that will not result in violations of the nondegradation policy---the same as surface or ground water discharge permit.

This supposition is substantiated by the lack any other procedures outlined in the rules that provide for "pollution sources not subject to permit requirements," such as mines discharging into groundwater, with any other procedure through which to seek a nondegradation exemption. So the mining company must petition for the exemption as an amendment to its mine permit the same as it would for a surface or ground water permit. The only other viable conclusion from the nondegradation rule language is that mines are prohibited from seeking nondegradation exemptions for groundwater degradation, because, as the rules are written, only those sources who have been issued ground water or surface water permits are allowed to petition for a nondegradation exemption through an amendment to these permits. Neither the Metal Mine Reclamation Act, nor its rules provide for any procedure for a mining company to petition for a nondegradation exemption. In fact, the MMRA requires the mine reclamation plan "to prevent objectionable postmining ground water discharges." [82-4-336 (9), MCA] 15-25

**COMMENTS ON SECTION 4.2, SURFACE WATER RESOURCES**
**Section 4.2.1 Alternative 1 - No Action**

This section provides no cost/benefit analysis of the "no action" alternative as it compares to allowing alternatives that degrade high quality waters. Such a cost/benefit analysis is required by Section 16.20.704 (3), ARM, of Montana's nondegradation rules. 15-26

**Section 4.2.2 Alternative 2 - Proposed Action**

**P. 4-7. Paragraph 6.**

No factual basis of claim that "mine wastes would be expected to be similar to the Stillwater." No factual basis that "a lowered pH is not 15-27

expected, and that there should be no or only minor mobilization of metals in waste rock. No factual basis that "...no adverse impacts to surface water resources are expected from...the waste rock piles...." 15-27

No mitigation plan discussed for the contingency should "...lithologies with different geochemical compositions which create conditions for acid mine drainage could be encountered during mining." This fails to meet requirement of the MMRA, 82-4-335 (4) (m), MCA, that says that the company must develop "a plan identifying methods to be used to monitor for the accidental discharge of objectionable materials and remedial action plans to be used to control and mitigate discharges to surface and groundwater." 15-28

**P. 4-8, Last Paragraph**

More hydrological data needs to be gathered to develop sound mitigation measures to mitigate potential surface water impacts from percolation into the East Boulder River. The inadequacy of the current data is exposed by the following statement: "The exact amount of increase [from percolation] is unclear because of uncertainty over how much mine water would be produced." 15-29

**P. 4-9, Paragraph 3, 4 & 5**

These paragraphs do not provide enough factual data to support their conclusions that arsenic, mercury and lead "should not cause mine discharge concentrations to be elevated above those found in natural background conditions." The agencies should require enough factual information about the proposed mine area---not the Stillwater Mine---to affirmatively demonstrate that degradation will not occur. 15-30

**P. 4-14, Paragraph 1**

It would violate Montana's nondegradation policy to permit the East Boulder Mine with this admission that "...the mine discharge would change the river's water quality by increasing concentrations of some metals and compounds, [resulting in] Montana's nondegradation rules...[being] violated..." as admitted here. The East Boulder Mine would represent a new and expanded pollution source, and therefore is not eligible for a nondegradation exemption. 15-31

What's worse is the next sentence which admits that the mitigation measures are so inadequate that "...iron concentrations could exceed allowable levels established under the Clean Water Act and adopted by the state of Montana." This appears to say that it is likely that the proposed mitigation measures would not only fail to prevent degradation of ambient standards, but also of drinking water standards.

Both of the above scenarios would violate both state and federal nondegradation policies of the Montana Water Quality Act and the Clean Water Act. 15-31

**P. 4-14, Paragraph 2**

Recent court cases provide arguments for requiring any discharges of pollutants into groundwater hydrologically connected to surface water to be permitted with a surface discharge permit. Will the WQB require such groundwater discharges as described in this paragraph to obtain a surface discharge permit? 15-32

The following statement in this paragraph is disturbing: "Groundwater discharge would impact the quality of the groundwater...but reduce the impact on the East Boulder River when compared to direct discharge...." The high quality groundwater aquifer that could receive these discharge should not be viewed as a treatment plant for surface water as this sentence appears to imply. It deserves the same protection under the nondegradation policy as surface water. Once again [as has happened in the Cabinet Mountains and other Montana mines] the agencies appear to be allowing the company to circumvent required treatment through discharges to groundwater. This would also violate section 82-4-336 (9) of the MMRA that requires the reclamation plan to "...provide measures to prevent objectionable postminingg groundwater discharges." 15-33

**P. 4-14, Paragraph 4**

No mitigation measures are described "to prevent pond overflow" that would likely be necessary because of the clogging of the percolation ponds. 15-34

**Section 4.2.3 Alternative 3 - Modified Tailing Impoundment**

**P. 4-16**

Stillwater PGM should post a reclamation bond adequate to cover clean up costs in case of dam failure of the tailing impoundment. 15-35

**Section 4.2. Alternative 4 - Alternative Access Road/Power Line Alignments**

**P. 4-17, Paragraph 2**

Stillwater PGM should post a reclamation bond adequate to cover costs of accidental spills. Remedial plans should be required that outline how the company and local officials will respond to such spills. 15-36

**Section 4.2. Alternative 6 - Water Treatment Alternatives**

Alternatives 6 (B) and 6 (C) both include admissions that they will violate nondegradation standards. Therefore Alternative 6 (A) is the only alternative that can be permitted under the Montana Water Quality Act's nondegradation policy. (See discussion in first two section of these comments above.) However, even Alternative 6 (A) can only be permitted if it affirmatively demonstrates that it will prevent degradation. 15-37

**Section 4.3.2 Alternative 2 - Proposed Action**

**P. 4-27, Paragraph 2**

No factual data to substantiate claim that "...the maximum seepage rate is estimated to be 0.4 gpm." No factual data to substantiate claim that "The quality of tailing water would be expected to be similar to that at the Stillwater Mine" is given. 15-38

SPGMR is prohibited from obtaining a "...variance from the Montana non-degradation rules," as it admits it will have to do in this paragraph "to operate the tailing facility in this fashion." This seepage would also violate the requirement in section 82-4-336 (9) of the MMRA that requires the reclamation plan to "...provide measures to prevent objectionable postmining groundwater discharges." 15-39

The last sentence of this paragraph indicates potential degradation of surface water through groundwater discharges. Therefore a surface discharge permit should be required that imposes the degree of treatment necessary to maintain the high quality waters of the East Boulder River. 15-40

**SUMMARY OF ARGUMENTS SUPPORTING NONDEGRADATION OPTION**

In summary, the Cottonwood Resource Council (CRC) and the Northern Plains Resource Council support Alternative 6 (A) in the Draft EIS because it is the only alternative that would require treatment of discharges to a degree that may prevent degradation of the East Boulder River's high quality waters. The following are specific arguments against allowing any alternative that would violate Montana's nondegradation policy: 15-41

• Montana's Constitution requires state agencies to "maintain and improve a clean and healthful environment...for present and future generations." Allowing degradation of the East Boulder River is inconsistent with this constitutional mandate.

•Montana's Water Quality Act requires the state to "...conserve water by protecting, maintaining, and improving the quality...of [the state's] water. Allowing degradation of the East Boulder River is inconsistent with this statutory requirement. Degradation would also be inconsistent with the federal Clean Water Act's goal "...that the discharge of pollutants into navigable waters be eliminated by 1985."

•The nondegradation policy of the Montana Water Quality Act arguably prohibits new or increased sources of pollution from obtaining a nondegradation exemption. That is, the exemption is available only to existing water discharge permit holders. Chevron/Manville's East Boulder Project does not hold an existing discharge permit, and represents a new source of pollution. Prohibiting degradation would be consistent with this interpretation of the Water Quality Act.

•Requiring treatment to prevent degradation would be consistent with Section 75-5-303 (2), MCA, of Montana's nondegradation policy which requires a "...degree of waste treatment necessary to maintain...existing high water quality."

•Montana's nondegradation rules require a petition for a nondegradation exemption to be treated as *an amendment to an existing surface* or *ground water discharge permit* that contains conditions *that would not allow degradation*. The agencies' granting of Alternative 6 (A), requiring a surface discharge permit not allowing degradation, would be consistent with procedures provided petition the Board of Health in the state nondegradation rules. Alternatively, permitting the East Boulder project without requiring best available technology that would prevent degradation would violate the nondegradation policy of both the Montana Water Quality Act and the federal Clean Water Act. 15-41

•Not requiring Chevron/Manville to utilize the best available technology to prevent degradation would violate the mandates in both the Montana Water Quality Act and the federal Clean Water Act to protect present and future beneficial uses of the state's water resources.

•Not requiring Chevron/Manville to utilize the best available technology to prevent degradation would violate the mandates in both the Montana Water Quality Act and the federal Clean Water Act to prevent degradation of high quality waters below naturally occurring ambient background conditions.

•Permitting the East Boulder project under Alternative 6(A) would be more likely to eliminate the need for the company to petition for a nondegradation exemption than the other proposed alternatives allowing degradation. This could avoid potential legal challenges that may result from the Environmental Protection Agency's disapproval in 1989 of several state rules implementing federally mandated requirements related to the state's nondegradation policy, its provisions for so-called "mixing zones" in permit areas, its protection of beneficial uses, and its requirements for best management practices for non point pollution sources.

•Permitting the East Boulder project under alternatives that would allow discharges into ground water hydrologically connected to the East Boulder River without requiring a surface discharge permit could violate the federal Clean Water Act under recent court interpretations. Alternatively, permitting the mine under alternative 6 (A), which would require a surface discharge permit, would eliminate this contentious issue.

•The Metal Mine Reclamation Act (MMRA) requires a reclamation plan that "provides measures *to prevent* objectionable postmining groundwater discharges [emphasis added]." Allowing any alternatives that the agencies have determined would result in degradation---as evidenced by the acknowledgment of the need of a nondegradation exemption---would violate this provision of the MMRA. The MMRA also requires remedial mitigation plans to be in place to clean up accidental spills or discharges into groundwater. There are several potential opportunities for such accidents to occur described in the draft EIS, but the required remedial plans are absent or inadequately described. 15-41

•Chevron/Manville, Inc., should voluntarily post a bond to assure continued adequate prevention and treatment of all potential water pollution anticipated to be generated from the mine. Such voluntary bonds are now allowed under the Water Quality Act.

MADISON GALLATIN ALLIANCE

August 2, 1991

Ms. Jo Stephen
Reclamation Division
Montana Department of State Lands
Capitol Station
Helena, MT. 59620

RECEIVED
AUG 5 1991
STATE LANDS

Re: East Boulder DEIS

Dear Jo:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement for the Stillwater PGM Resources (SPGMR) East Boulder mine proposal. The Madison-Gallatin Alliance offers the following comments.

For the record, MGA is a grass-roots conservation organization based in Bozeman. Our current membership is approximately 200. We are a chapter of the Montana Wilderness Association.

Project-associated traffic on the Main Boulder and East Boulder roads is of great concern to us. Heavy traffic loads on these narrow roads would mean a high potential for accidents, material spills, wildlife road kills and subsequent bald eagle deaths. SPGMR should be required to minimize traffic by instituting an employee busing program and adhering to a 3 passenger/vehicle target. In addition, daily removal of roadkills should be required during the seasons when bald eagles are present. 16-1

We are also very concerned about potential impacts on water quality in this heretofore-pristine drainage. As the tailings pond will be perched immediately above the East Boulder River, the integrity of the dam is of critical importance to the river. We strongly support the lessened dam slope (2:1) proposed by the agencies, and ask you to require this as a permit condition. 16-2 The permit should also require a tailings dewatering program, and adequate provision for tailings stabilization and revegetation to assure long-term protection of the river. 16-3 Furthermore, we object strongly to the proposed water quality non-degradation waiver for water discharged from the operation. What's the point of enacting 16-4





legal standards if violations are officially permitted? Once a single such waiver is granted DSL will be deluged with waiver applications and will be hard put to deny them. The results would be disastrous for water quality statewide. Instead of permitting degradation of the East Boulder River, the agencies should require SPGMR to treat its wastewater/drainage water to meet ambient standards. 16-4

Finally, we're worried about the agencies' apparent hands-off regulatory attitude, as evinced in the DEIS. It is wrong for the DSL and the Forest Service to merely suggest mitigation and monitoring measures, and rely on the good will of SPGMR for their implementation. Strong monitoring and mitigation measures must be explicit conditions of the permit; they must, of course, be backed up by appropriate bonding requirements. Laissez-faire has no place in setting legal permit conditions. 16-5

In Montana we already pay high costs - both in dollars and environmental quality - for past mining that was insufficiently regulated. Each new permit application presents the agencies with a clear choice: exacerbate the existing problem, or do it right this time. We ask the two permitting agencies to exercise diligent stewardship of our common resources, so that our children and grandchildren will not have to pay still higher costs.

Sincerely,

Joe Gutkoski

Joe Gutkoski
Vice President, MGA

Greater Yellowstone Coalition

OCT 1 1 1991
STATE LANDS

October 8, 1991

Ms. Jo Stephen
Montana Department of State Lands
Capitol Station
Helena, MT 59620

Dear Ms. Stephen:

The Greater Yellowstone Coalition would like to submit the following comments on the Draft Environmental Impact Statement on the proposed platinum/palladium mine along the East Boulder River south of Big Timber.

WATER RESOURCES

The prospect of degraded water quality in the vicinity of the mine is of utmost concern to the Coalition. Minimum information was provided in the DEIS on the water treatment alternatives, the potential for hazardous waste generation and effects on water quality, including concentrations of metals, dissolved solids and other compounds. We would like to see a more comprehensive discussion of the impacts of degradation, effects on aquatic insects and fisheries, and more detail on the various water treatment plant options so that the public can evaluate the alternatives. The potential impacts of encountering water-bearing fissures should be addressed more fully, as well the potential for acid mine drainage. 17-1

The recent events at the Blue Range Mine in Lewistown, where cyanide was found in a monitoring well one month after the company added a cyanide circuit - despite DSL estimates that escaped cyanide would take 15 years to reach monitoring wells - illustrate the uncertainty behind the effectiveness of water protection measures at mineral operations. The risks associated with potential degradation, however, are simply so great that the best available technology to minimize the potential for degradation and assure maintenance of high quality waters should be implemented. 17-2

The public water policy of this state is to prevent water pollution, and to maintain and enhance water quality. The company has identified an alternative which would do that, and the justification for choosing another alternative has not been presented. We urge you to require a water treatment operation, such as that proposed under alternative 6A, that will not allow these waters to be degraded. 17-3

This position is consistent with the 1988 settlement agreement between the Coalition, the Wilderness Society, Stillwater PGM Resources (SPGMR) and the Forest Service, which includes water quality mitigation measures. This agreement states that "These measures are designed to preclude the degradation of the water quality of the East Boulder River and to maintain the current 17-4

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fishery." The goal of preventing degradation of water is just as appropriate now as it was when that agreement was signed. 17-4

The final EIS should also describe the geothermal history of the area, and an analysis of potential impacts of mine operations on geothermal aquifers. This is a point we raised in our scoping comments as well. 17-5

TAILINGS IMPOUNDMENT

We support the 2:1 slope proposed by the agencies, rather than the 1.6:1 slope proposed by the company. The 2:1 slope provides more stability, less visual impact, and would greatly improve prospects for reclamation and revegetation of the slope. There are no compelling reasons for the steeper slope. The potential increase in tailings pond capacity is not justification for the steeper slope, considering the uncertainty of reserves and ultimate tailings volume. 17-6

Dewatering of the tailings mass is particularly important and should be required. As the agencies noted in the DEIS, the absence of such system would make the proposed reclamation gradient impracticable and would increase both the degree and time of consolidation and ultimate settlement, leading to reclamation that is very likely to be unsuccessful. 17-7

We are concerned about the absence of any feasible alternate tailings disposal site. SMC is already requesting amendments which provide additional impoundment capacity, only five years after beginning operations. During the initial review of that permit, alternative disposal sites were identified. We are concerned about the implications of permitting a mine where additional reserves are possible, and in fact likely, judging by the situation at Nye. 17-8

We would like to see an analysis in the FEIS of potential for expansion at the existing site. We raised this issue in our scoping comments, but it has not been adequately addressed in the DEIS. 17-9

RECLAMATION AND BONDING

Reclamation and bonding requirements should be established to ensure that the site is stabilized, revegetated and restored to pre-mining land use conditions, as required by law. The permit should include provisions for review of bonding levels and reclamation requirements as needed, and the FEIS should clearly state how successful revegetation and reclamation will be measured, i.e., comparable utility and stability as existed before disturbance. 17-10

Restoration of disturbed lands to pre-mining land use conditions should be the end to which reclamation and revegetation efforts, bonding levels, and post-mining maintenance activities are directed. The chosen alternative should provide assurances that this goal will be accomplished. While we understand the need for some flexibility to allow the incorporation of improved technology, this document is pervaded by unclear and weak monitoring, mitigation and reclamation language. The public should feel confident that the resource conditions that are projected in the final EIS are the minimum that can be expected, and that if those conditions are violated, the agencies will act immediately to rectify the violation. Discussion of measures that 'could' or 'would' protect human safety and environmental resources, but are not clearly required, do not provide necessary assurances. 17-11

For example, there is conflicting language within the DEIS about whether a system to dewater the tailings mass will be required; whether geotechnical testing to assess impoundment stability will be required; and whether the company will be required to maintain an effective surface water diversion around the tailing impoundment. These FEIS should clearly state that these measures will be required. 17-11

We have heard differing estimates of available soils, although the DEIS analysis indicates that soil salvage difficulties due to large rock masses may preclude the salvage of estimated soil volumes. A firm estimate of soils available for reclamation needs to be developed, along with a specific proposal for how the company plans to meet reclamation and revegetation requirements if salvage of estimated soil volumes is not possible. 17-12

Finally, reclamation plans should ensure compliance with forest plan visual quality standards by requiring vegetation management programs where visual quality standards may be exceeded. Stillwater Mining Company (SMC) has apparently met with limited success with its mixed conifer shelter belt, which was planted to reduce visibility of project operations, because of excessive sand blasting by wind borne particles. How will this difficulty be addressed at the East Boulder site? 17-13

MONITORING AND MITIGATION

The idea of implementing perpetual pond maintenance, with monitoring and control systems operated "in perpetuity" is ludicrous. In Montana and throughout the West we have been left with a legacy of abandoned mines which threaten the health of our citizens and the integrity of the natural environment, and impose a tremendous burden on taxpayers. Yet this issue of perpetual maintenance was described in a couple sentences in the DEIS, certainly not enough for citizens and taxpayers to evaluate the responsibility that was being expected from them "in perpetuity". This mine should not be permitted unless it can be operated without imposing this perpetual maintenance responsibility on someone else. 17-14

WILDLIFE

Part of this project area HEI standard is at 56%, due primarily to timber harvest and roading from previous timber sales. This is far below the minimum forest-wide standard of 70 percent. In order to achieve an HEI closer to the forest plan standard, the agencies should establish as part of this process a program to effectively close other roads and revegetate disturbed areas as soon as possible. 17-15

The East Boulder area is black bear spring and fall habitat, which the DEIS states will be eliminated and bears displaced from the surrounding area. Strict refuse control and collection procedures should be required so that refuse does not attract bears to the project area and result in adverse human-bear interactions. 17-16

Measures should be implemented to prevent wildlife from becoming habituated to the tailings impoundment area as a source of water. 17-17

Raptors

* The permit should require the company to remove road-kill fauna, a measure which is required of SMC at Nye, to reduce potential impacts to raptors that inhabit the area. 17-18
* The company should not be allowed to disturb the peregrine hacksite west of the mine project site. 17-19
* A company program that educates personnel regarding wildlife species, especially raptors and potential harmful impacts to raptors, should be encouraged. 17-20

RECREATION

The DEIS states that newcomers to the area would be expected to participate in recreational opportunities at the same level as current residents, of which about 60% hunt and fish, yet a 1988 Stillwater Mining Co. survey of personnel at Nye showed that 94% fished. Since a large portion of the Yellowstone and Main Boulder Rivers run through private land, and access is limited, this will concentrate increased numbers of fishermen on the readily accessible public fishing areas. Hunting pressures are expected to increase as well. Why is there a discrepancy between these figures? These projections should be reevaluated, and annual surveys of employees regarding family recreational use patterns for assessing fishing, wildlife and recreational pressures should be implemented. 17-21
An educational program for employees on Wilderness, impacts of illegal ORV use, and poaching might help avoid resource abuses and should be encouraged. 17-22

TRAFFIC

Traffic on the East Boulder road is one impact that local residents in particular, as well as recreational visitors, will confront on a daily basis. The road location so close to private residences, and the narrow road corridor immediately adjacent to the river, make the issue of traffic even more critical, and controversial.

We would like to see a projection of the maximum mine-related traffic on this road to which transportation plans could be targeted; this projection should encourage the minimal traffic necessary. A target during operations, of, for example, 75 or 100 round trips per day, could be established, leaving the company with the flexibility to determine how to reach that target. Options could include establishing a bussing program or requiring carpooling with minimum numbers of employees per vehicle; these requirements can be instituted as a condition of employment. Traffic problems could also be minimized by controlling times of highest mine traffic, such as shift changes, to avoid school traffic, and limiting delivery traffic to particular days of the week. 17-23

Unfortunately, the DEIS seems to be going in the opposite direction, projecting fewer employees per vehicle at this site than is targeted at SMC's Nye operation, where traffic routes are more disperse and carpooling may be more difficult. The East Boulder projections should be encouraging less traffic, considering the limited routes available to access the mine site. 17-24

The size of the parking lot is an issue the Coalition and others have raised many times with agency personnel, but to which we have not yet received a satisfactory response. If bussing or carpooling is effectively instituted, why is a parking lot for 200 cars needed? We would like to see a more detailed examination of traffic projections and proposed transportation plans, with the size of the parking lot directly related to traffic targets and maximum crew sizes. 17-25

SOLID AND HAZARDOUS WASTES

The use, transportation and storage of hazardous materials needs to be addressed. 17-26 In addition, the impact on the lifespan of the city's solid waste disposal site should be evaluated. 17-27

TIME FRAME FOR PERMIT

A time frame such as five years should be placed on the permit in case development is delayed. Current low platinum prices, problems with the joint venture, or other problems may result in a prolonged delay in development of the mine. In the meantime, socio-economic or environmental conditions reviewed in the EIS, including cumulative impacts or Projects of Concern, may have changed significantly, and should be reevaluated before the company is allowed to proceed. 17-28

SOCIO-ECONOMIC IMPACTS

Montana's Hard Rock Impact Act notwithstanding, the FEIS should provide a better analysis of socio-economic impacts associated with development of this mine. The layoffs in Stillwater County illustrate these concerns quite clearly. The potential socio-economic impacts of temporary shutdowns or layoffs should be addressed. 17-29

We appreciate the opportunity to comment, and look forward to working with you on this project.

Sincerely,

Jeanne-Marie Souvigney

Jeanne-Marie Souvigney

Stillwater PGM Resources
A Chevron, Manville Partnership
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118 West First Avenue
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October 1, 1991

Ms. Sandra Olsen
Chief, Hard Rock Bureau
Montana Dept. of State Lands
1625 11th Avenue
Capitol Station
Helena, MT 59620

Mr. Steve Brady
District Ranger
Gallatin National Forest
Big Timber District
P.O. Box A
Big Timber, MT 59011

Re: Draft EIS Comments.

Dear Ms. Olsen and Mr. Brady:

Enclosed are SPGMR's comments on the draft EIS for the East Boulder Project. In general, SPGMR is pleased with the document which adequately explains and discloses the company's proposal, agency responsibilities, project alternatives, and environmental impacts of the project to the public.

SPGMR's comments are grammatical as well as substantive and include reference to typo's, punctuation and usage errors, as well as technical responses to issues raised by mitigation measures being proposed under Alternative 7. In addition, specific comments related to environmental resources, such as air and water, will be addressed individually through contractors working for SPGMR. For convenience, the page, section number, and paragraph have been cited in our comments for reference. Additionally, proposed changes in current language has been struck-out and proposed new language highlighted for convenience.

Sincerely,

Bruce Gilbert
Environmental/Permitting Supervisor

Enclosure

Page 2-80, Section 2.5, Last paragraph:

Comment: Since this is a disclosure document, it should be pointed out to the public in the last paragraph that the agencies can and will modify or delete mitigation measures outlined in the draft EIS and implemented in the plan of operations if under actual operating conditions, and on the basis of site specific technical analysis, it can be shown that the mitigation measure is no longer relevant. Likewise, if the mitigation is insufficient to address the actual impacts, modification of the mitigation measure could result in an increase in mitigation measures, controls, and/or monitoring frequencies and durations. This responsibility and authority is at the discretion of the agencies and their professional staff and may not be open to public review and/or comment unless the changes substantially increase the impacts analyzed in the EIS and/or these changes are inconsistent with the regulatory intent. 18-1

Page 2-81, Section 2.5.1, Paragraph 1:

* SPGMR would suggest that the last sentence be changed to read: 18-2

"SPGMR would be required to develop a plan for ~~perpetual~~ pond maintenance so that appropriate bonding can be set. **Bond would be released when adit water quality met background conditions or standards determined by the Board of Health and a permanent diversion to the East Boulder River constructed and satisfactorily reclaimed.**"

Comment: Additionally, the agencies might want to consider the conversion of the ponds to wet lands. This action should relieve SPGMR of long term maintenance obligations while providing the USFS with a wet lands mitigation project for disturbances related to future timber sale or road building activities. 18-3

* SPGMR would suggest that the last sentence of the second paragraph be changed to read: 18-4

"Water treatment, **as determined by the Board of Health,** would be bonded as a contingency until mine drainage and impoundment seepage meet effluent requirements **as determined by the Board of Health or baseline water quality standards.**"

Page 2-81, Section 2.5.2, Paragraph 1:

* SPGMR would suggest that the last sentence of the first paragraph be changed to read: 18-5

"A system for preventing surface water runoff from entering the facilities area (i.e., berms), as well as a system for channeling surface water runoff within the permit areas to the percolation ponds, sediment traps, clarifiers or other approved structures which are consistent with "Best Management Practices (BMPs) must be designed and approved by the agencies."

Page 2-81, Section 2.5.3:

Comment: The agencies may want to delete the reference to the septic system in the narrative and restructure the paragraph since it gives the impression that monitoring wells will be required to specifically monitor the quality of septic and percolation pond discharges. Currently, neither the DHES board, WQB, nor DSL are interested in monitoring septic systems. The agencies are interested, however, in the total impact to ground waters at the point that the water leaves the permit boundary. Therefore, proposed monitoring sites should be positioned around the periphery of the permit area except in the cases where piezometers may be installed to monitor ground water levels and their possible effect upon impoundment stability. 18-6

Page 2-82, Section 2.5.5:

Comment: Although SPGMR has little concern with mitigation measures which are designed to determine settling and distribution rates prior to tailings surface reclamation, mitigation to a 2:1 slope is of concern to the company for the following reasons: 18-7

1) A 2:1 slope will reduce tailings capacity and shorten the useful life of the impoundment by more than 10% or 2-3 years.

2) Waste rock schedules utilizing the proposed production rate were used in the design of the structure. A 2:1 slope would require 10% more waste rock (650,000 tons) which may have to be excavated and hauled from a barrow source which is yet undefined.

3) Environmental impacts associated with a possible barrow source and the construction of an another tailings impoundment 3-5 years earlier than necessary would need to be addressed either in this environmental document or in a subsequent assessment.

4) SPGMR would incur additional costs associated with the construction and final reclamation of a 2:1 slope which could affect profitability and future expansions.

5) A 1.6:1 slope and the rock armor proposed is consistent and compatible with the major visual landforms within the East Boulder valley.



6) Habitat loss as a result of a 1.6:1 armored slope would be minimal and could be mitigated by habitat improvements elsewhere in the valley.

7) The difference in stability is negligible and considered by most engineers to be inconsequential. Additionally, given the distance from camp grounds and valley residents the stability factor is more than adequate to protect the human population of the area.

8) A significant difference in reclamation success has not been demonstrated by the agencies. Final reclamation success is more likely to be a factor of reclamation technique, percentage of vegetation vs armor, and weather and moisture conditions at the time of final reclamation rather than a factor of slope. 18-7

Should the agencies select a 2:1 slope as their preferred alternative they should examine the environmental and economic consequences to the East Boulder valley and to SPGMR. Additionally, it should be made clear that the 2:1 slope is a final reclamation slope and that on-going construction at slopes which may approach angle of repose does not affect the overall stability since the tailings do not reach final design elevation until well after the final stage of construction.

SPGMR has provided the agencies with all the information necessary to make an informed decision based upon site specific technical data (see Appendix D and completeness responses). The final decision should be based upon these facts and the environmental analysis which has been conducted to date, not on emotional bias and concerns over setting a reclamation precedent.

Page 2-83, Section 2.5.6:

* SPGMR would suggest that the last sentence of the first bullet be changed to read: 18-8

"In addition, SPGMR would develop procedures for training personnel on the proper use of dust control chemicals or utilize the services of a trained and licensed contractor."

Page 2-84, section 2.5.6:

* SPGMR would suggest that the first bullet be changed to read: 18-9

"A plan for final road reclamation on private lands ~~at the end of mine life would have to be~~ must be developed and approved if an alternate road alignment is chosen and

the road is not being proposed as a permanent county or public road." 18-9

* SPGMR would suggest that the third bullet be changed to read: 18-10

"Designated company parking areas ~~Employee parking~~ would not be allowed outside the permit area ~~tailings impoundment boundary~~...."

* SPGMR would suggest that the sixth bullet be changed to read: 18-11

"If chemical dust retardants are contemplated on roads, SPGMR would provide the agencies with a material safety data sheet and recommended concentrations and application rates for approval prior to use. Based upon this information the agencies would perform a risk analysis of the potential for contamination of groundwaters by the chemicals, and their potential threat to groundwater users and surface waters/aquatic communities".

Comment: Analysis of the risk and appropriateness of the proposed action is the responsibility of the agencies.

Page 2-84, Section 2.5.7:

* SPGMR would suggest that the paragraph be changed to read: 18-12

"A plan for more detailed monitoring of waste rock types and volumes would need to be developed by SPGMR, approved by the agencies and implemented ~~upon waste rock production. The plan should present steps to be taken~~ should waste rock which may generate acid drainage be encountered during mining activities. ~~so that heavy metals are not released to the environment.~~ Particular attention would have to be given to waste rock from faults and lithologic contact zones".

Page 2-84, Section 2.5.9:

* SPGMR would suggest that the paragraph be changed to read: 18-13

"Although SPGMR's latest soils and reclamation studies indicate the presence of large volumes of soils in most of the permit areas, some question has been raised as to how accessible those soils will be. Therefore, all soils which can be reasonably salvaged from disturbed areas and which are suitable for reclamation must be salvaged to ensure an adequate reclamation supply. In addition, fuel storage areas must be lined with low-permeability material to prevent contaminant seepage into groundwater.



Finally, soils stockpiles should have 2(H):1(V) slopes rather than the 1.6(H):1(V) slopes proposed by SPGMR. If there is not enough room for this configuration, a 1.6(H):1(V) slope would be allowed. However, should reclamation and surface stabilization be deemed inadequate ~~with~~ additional material, such as netting, may be required to minimize erosion until revegetation can stabilize surface soils." 18-13

Page 2-85, Section 2.5.10:

* SPGMR would suggest that the last sentence of the last paragraph be changed to read: 18-14

"* The plan must address impacts to water quality, downstream users, wildlife, ~~long-term impacts,~~ and other issues as determined by the GNF and DSL.

Comment: Addressing "long term impacts" in the context of evaluating the effectiveness and adequacy of an contingency plan is the responsibility of the agencies.

Page 2-85, Section 2.5.11:

* SPGMR would suggest that the second bullet be changed to read: 18-15

"SPGMR will be required to notify the agencies at least 24 hours in advance of permitted construction activities which will result in significant surface disturbance or may have a temporary impact on wildlife or other identified resources. The DSL and GNF will coordinate their review of the activity with MDFW&P or other affected agencies in order to minimize impacts during the construction activities."

Page 2-86, Section 2.5.13:

Comment: The section is unclear as to the criteria and conditions which may be used to define and mitigate visual impacts. Please clarify. 18-16

Page 2-86, Section 2.5.14:

* SPGMR would suggest that the paragraph be changed to read: 18-17

"~~Upgraded~~ Muffling systems would be ~~used~~ installed and maintained in good working order on all dedicated



facility construction and operation equipment and vehicles to minimize noise levels. Also fans in ventilation shafts on the East Boulder Plateau would be contained in noise insulated enclosures or located far enough inside the shafts so as to minimize noise near wilderness areas. In addition, radar-detector back-up beepers would be used on company equipment on the East Boulder Plateau so that audio warning signals are sounded only when necessary." 18-17

Page 2-86, Section 2.5.16:

* SPGMR would suggest that the paragraph be changed to read: 18-18

"... The location of breakouts (adits, vents, raises, shafts) ~~must be approved by~~ will be sited with the cooperation and review of the GNF and DSL prior to their construction. ~~A cultural resource survey, vegetation survey, including wet lands analysis, soil survey, and threatened and endangered species survey, must be conducted prior to the approval of breakouts.~~"

Comment: It has been the practice at SMC to coordinate the location of surface facilities with the agencies prior to construction in order to minimize impacts to environmental resources. SPGMR is committed to following this same practice. However, it should be pointed out that although minor changes can be made in the location of facilities the narrowly defined area of the ore body often dictates the final location.

The surveys referenced in the final sentence have been conducted and are part of the over-all analysis contained in the EIS in reviewing SPGMR's plan of operation. Although it may be appropriate for the agencies to consider these resources and the EIS analysis (conducted during the initial permitting phase of the operation) as guidelines in siting these surface facilities, the requirement that SPGMR reconstruct baseline information for the purpose of an environmental analysis and final siting approval is not only duplicative in nature but also unwarranted given the analysis currently underway.

Spelling and Other Errors

p.ii, Section 2.6.1 "(GNF)" should be written out the first time--Gallatin National Forest 18-19

p.iv, Section 3.9.1 There shouldn't be an orphaned section--should be combined into Section 3.9 Air Quality 18-20

p.S-8, Alternative 3, line 2, "expect for" should be "except for" 18-21

p.1-7, title Montana Department of Health and Environmental Sciences, should be the same name under Air Quality Bureau, first line--not Montana Department of Health and Environmental "Services" 18-22

p.2-18, first paragraph, line 3, "stopping" should be "stoping" 18-23

p.2-49, first paragraph, line 5, "advancesin" should be "advances in" 18-24

p.2-65, Section 2.4.1.4, line 3, "slurring" should be "slurrying" 18-25

p.2-78, paragraph 2, line 2, "approximateluy" should be "approximately" 18-26

p.3-33, Section Mule Deer, paragraph 3, line 4, "1998" should be some other year 18-27

p.3-41, first paragraph refers to stream width in feet: second, third and fourth paragraphs refer to width in meters--should be consistent 18-28

p.3-44, Section 3.8 "VEGETATION,WETLANDS,AND TIMBER RESOURCES" should be "VEGETATION, WETLANDS, AND TIMBER RESOURCES" 18-29

p.3-48, paragraph 7, first line, "an complex" should be "a complex" 18-30

p.3-86, Table 3.13-1, footnote c "National Park Service0" should be "National Park Service" 18-31

p.3-111, first paragraph, last line, "Groosey" should be "Goosey" 18-32

p.4-33, Section 4.3.8, line 7, "meed" should be "meet" 18-33

p.4-37, Section 4.5.2.3, paragraph 2, line 2, "slopes" should be "stopes" 18-34

p.4-37, Section 4.5.2.3, paragraph 3, line 1, "sloping" should be "stoping" 18-35

p.4-53, 4.7.4 Alternative 4, paragraph 2, line 3, "bridges" should be "bridge" 18-36

p.4-108, Table 4.14-7, spacing in the table does not make it possible to understand numbers **18-37**

p.4-123, Section 4.16, "ENVIRONMENTALIMPACTS BY ALTERNATIVE" should be "ENVIRONMENTAL IMPACTS BY ALTERNATIVE" **18-38**

p.4-127, paragraph 3, "Livingstone" should be "Livingston" **18-39**

p.4-134, Section 4.18, bullet 2, line 2, "Benc" should be "Bench" **18-40**

p.A-9, bullet 7, "effect" should be "affect" **18-41**

p.A-10, bullet 3, "effect" should be "affect" **18-42**

p.A-12, bullet 2, references Section 4.14.1.11--cannot find section in EIS **18-43**

p.A-14, dash 2, references Section 4.14.1.11--cannot find section in EIS **18-44**

Following Are Corrections for the "Biological Assessment East Boulder Mine Project:

p.19, paragraph 3, line 9, "month" should be "mouth"



Hydrometrics, Inc.

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JUN 10 1991

June 7, 1991

Ms. Jo Stephen
Project Coordinator
Montana Department of State Lands
Capitol Station
1625 Eleventh Avenue
Helena, Montana 59620

RE: COMMENTS ON SPGMR EAST BOULDER PROJECT DEIS

Dear Jo,

The following are comments on the East Boulder Project Draft Environmental Impact Statement (May 1991).

Chapter 2

p2-3 para 5;
Reference is made to exceedance of water quality criteria for iron. This is not substantiated (see Table 4.2-3). **19-1**

p2-74 para 6;
States "Implementation of [reverse osmosis treatment] would result in no degradation to water quality." Further states (para 2, next page), "reverse osmosis removes 97 percent of nitrogen". This degree of treatment would still result in an increase in nitrogen concentrations in the East Boulder River. See Table 4.2-5a. **19-2**

p2-79 last para;
A geochemical partitioning model could be used to determine what effects alternative flocculating agents would have on metals. However, these models require many assumptions about the distribution coefficients of the various metals and the nature of the adsorptive surface of particulate materials which are difficult to quantify without empirical data. A more direct method would be to conduct bench scale flocculation tests. **19-3**

p2-81 para 2;
Reference to Alternative 6 should probably be Alternative 7. **19-4**





Chapter 3

p3-7 para 3;
Flow range for Canyon Creek is incorrect. Measured flows in 1989 (Hydrometrics, Inc., 1989) ranged from 24.2 cfs to no flow (dry). **19-5**

para 4;
100-year flood discharge estimated by BEAK is probably much too low (see discussion in BEAK, 1982). It should be noted that floodplain delineation was based on one half of the PMF (51,600 cfs) and not the 100-year flood. **19-6**

p3-9 Table 3.2-1
Parameter listed as "TSIN as N" should be "TKN as N". **19-7**

p3-11 Figure 3.3-1
Well site labeled "UDF" near the impoundment should be "UBR". **19-8**

p3-10 thru 3-14
No mention is made of the monitoring wells and the water supply well installed in 1989. No water quality or aquifer characteristics are presented for these wells. **19-9**

Chapter 4

p4-8 para 5;
Reference is made to "100-year floodplain". This should be "floodplain associated with one half of the probable maximum flood (PMF). **19-10**

para 6;
states "mine water would be discharged into percolation ponds." Should further state that mine water would be discharged primarily to percolation ponds with spray irrigation, spray evaporation, and surface discharge to the East Boulder River as secondary alternatives. Clarify that total discharge rate (combination of all methods) is 737 gpm. **19-11**

para 7;
State " a long-term increase in streamflow is expected in the East Boulder River" due to percolation ponds. This is not substantiated. Existing data indicates the river loses surface water to the underlying sediments which would preclude groundwater inflow to stream (gaining stream condition). Increased streamflows may result if hydraulic load from percolation induces gaining stream conditions. **19-12**



p4-14 para 1;
States iron concentrations could exceed "allowable levels established under the Clean Water Act". This is inconsistent with Table 4.2-3 which shows that iron concentrations would be about three times lower (better) than the Montana Surface Water Quality Standard. **19-13**

para 4;
Clogging of percolation ponds is a concern; however, clogging is easily remedied by scraping and removing the fine sediment or scarifying the pond surface. **19-14**

para 6;
The East boulder River is a losing stream in the vicinity of the mine site. In addition, the deep alluvial aquifer in which the water supply well is completed does not appear to be hydraulically connected to the East Boulder River based on aquifer testing and static water levels. Therefore, no decrease in streamflow in the East Boulder River is anticipated as a result of groundwater appropriations. **19-15**

p4-16 para 3;
DEIS states " long term impacts of the increased streamflow are expected to include potential morphological changes in the East Boulder River." This is contradictory to p4-9, paragraph 1; which states " this [streamflow) increase will not impact channel morphology." **19-16**

The morphological characteristics of the East Boulder River (steep gradient with cobble and boulder substrate) are predominately the result of the topography and geology of the area and the nature of high flows in the river. The hard, resistant nature of the bedrock, the steep gradient of the stream, and the flushing action of the large spring runoff events preclude any substantial accumulation of fine sediment in the river. The small increase in baseflow that may occur would have minor, if any, impacts on stream morphology. **19-17**

p4-23 para 1;
These measures could reduce the possibility of low quality water entering the East Boulder River, however, low quality water is not anticipated from the mine. During the operation, mine discharge water would be of better quality than the drinking water standards and would not result in any increase in parameters above surface water standards in the East Boulder River. After closure of the mine, mine discharge water should improve and approach ambient groundwater quality. **19-18**

para 3;
The phrase "alluvial aquifer of the East Boulder River" is inaccurate and misleading. The water supply well is screened at a depth of 130 to 170 feet below the ground surface and more than 100 feet below the elevation of the East Boulder River. Surficial material at the site is composed of glacial sediments (primarily cobbles, gravel, and sand, with silt) of approximately 100 feet in thickness overlying what are believed to be alluvial sediments (primarily cobbles, gravel, and sand without silt). This deeper alluvial material was probably deposited by the ancestral East Boulder River prior to the most recent glaciation. Based on a 52 hour pumping test of the water supply well, the deep alluvial aquifer in which the water supply well is completed is poorly connected to the East Boulder River. No measurable effect of the river on drawdown was discernible during the test. The allegation that removal of water from the deep alluvial aquifer will "greatly reduce East Boulder River flows" is unsubtantiated. 19-19

Moreover, the authors also assert (p4-16) that discharge of water to the percolation ponds will <u>increase</u> flows in the East Boulder River. The possible nullifying effect of percolation pond discharge on streamflows should also be discussed. 19-20

**Chapter 5**

p5-1 para 2;
Reference is made to Alternative 6 (water treatment alternatives). This should probably be Alternative 7 (proposed action with agencies modifications). 19-21

Thanks for the opportunity to comment on the DEIS. If you or your technical staff have any questions or would like to discuss these comments, please feel free to contact me at (406)-443-4150.

Sincerely,

Scott Mason

Scott Mason
Geochemist

/sm

c: Sherm Sollid, Gallatin National Forest
Bruce Gilbert, Stillwater PGM Resources

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.ED
JUN 18 '91
STATE LANDS

McLeod, MT 59052
June 16, 1991

Ms. Jo Stephen, Project Coordinator
Mont. Dept. of State Lands
Capitol Station
Helena, MT 59620

Dear Ms. Stephen:

The Draft EIS for the East Boulder Mine Project has completely ignored the most important and damaging impacts that will be caused by the mine to the people who will be most severely affected. Each time we were summoned to your meetings and expressed our concerns and offered alternatives that would help to lessen the damaging effects this project will have on all of our lives and incomes, we were told immediately that our solutions were "not feasible" and the only feasible way was exactly whatever SPGMR had proposed. 20-1

We are sick of your duplicity. As long as the oil companies rule the world and have most of the politicians and government agencies in their pockets, us poor ordinary slobs might as well stay home, shut up and save our paper, ink and stamps.

Our most valuable assets in the West are pure water and agriculture. By the time these facts are recognized by those in "high places" our water will have been befouled beyond redemption and the people in agriculture will have been harassed off the land.

Your Draft EIS is a travesty, full of errors and an insult to all of us and the environment.

Most sincerely

Beth Deegan

Beth Deegan

cc: Sherm Sollid
Max Baucus
Ron Marlenee
Conrad Burns
Pat Williams
Larry Sears

---

To The Forest Service and S.P.G.M.R.

So far I have sat on the side line + listened and now the time has come for my feelings to be known about the way the existing road goes through my yard + under my porch and have land and buildings + livestock on both sides of the road which I'm forced to be on and accross many times during the day.

The amount of traffic would be completely prohibitive + would lower the value of our Ranch by 50 %.

I have been owner + resident for 45 yrs + have enjoyed the serenity + beauty of the East Boulder where we raised our family.

Therefore this is to inform you, my family + I intend to take any steps possible to not have this road used for mining purposes. We feel you have shown no regard for our well being. 21-1

Rec. 7/23/91

Lloyd Broughton

---

RECEIVED
AUG 2 1991
STATE LANDS

July 31, 1991
Box 477
Big Sky, MT 59716

Ms. Jo Stephen
Montana dept. of State Lands
Capitol Station
Helena, MT 59620

Dear Sir:

I'm writing concerning the Draft Environmental Impact Statement on the proposed mine along the East Fork of the Boulder River. I'd like my comments entered into the official record.

The proposed actions by Stillwater PGM Resources will degrade water quality. This must not be allowed to happen. This company's petition to be exempted from Montana water quality standards is ridiculous. If they can't mine without ruining the environment they shouldn't be mining. The exemption must not be granted. 22-1

The proposed slope of the tailings impoundment of 2:1 by the agencies is good. Stick to it. Don't let the company's proposed 1.6:1 slip by. Keep your standards high. Also dewatering of the tailings mass should be required. Reclamation and bonding requirements should be set up so the area can be returned to its current pre-mine condition. This is a very important point. 22-2

Another very important thing: Effective monitoring and mitigation measures must be required before the permit is issued. 22-3 It must be enforced and monitored strictly by the agencies. Don't trust the company to be environmentally aware. The track record of such operations in the past is very poor. 22-4

Because the area is black bear spring/fall habitat, strict control and collection of refuse should be required. 22-5 The proposed 200 vehicle parking lot should be scaled down and a bussing program encouraged. 22-6

Sincerely -

Jim Stoltz

Jim Stoltz

RECEIVED
AUG 1 1991
STATE LANDS

Ms. Jo Stephen,
Montana Dept. of State Lands,
Capitol Station,
Helena, MT 59620

Dear Ms. Stephen:

We are concerned in re the recent Draft Environmental Impact
Statement on the Stillwater PGM Resources' proposed
platinum/palladium mine along the East Boulder River south of Big
Timber. We understand that ,the company intends to submit a
petition to the State to be granted an exemption from the State's
water-degradation rules. We believe that this, if granted, would 23-1
be an ominous precedent, opening the door to other attempts to
degrade Montana's water quality, and urge that it be rejected.

We support your agency's proposed slope of 2:1 for the tailings
impoundment, rather than the slope of 1.6:1, and also support
requiring dewatering and the establishment of reclamation and
bonding requirements. Effective mitigation and monitoring 23-2
measures should be required as a condition of the permit and
strictly monitored and enforced rather than left to the
descretion of the company.

There should be a time limit on the permit if development of the
mine is delayed, so that changes in conditions reviewed in the 23-3
EIS can be re-evaluated if necessary.

Strict control and collection of garbage and other refuse is 23-4
necessary to avoid attracting bears.

Since the mine will probably drain water indefinitely, procedures
for perpetual drainage pond maintenance and maintenance of
surface water runoff from the tailings should be established and 23-5
monitored, with periodic review of bonding levels and reclamation
requirements as appropriate.

Since the large amount of rock mass in the area will impede soil
salvage, an estimate of the amount of soil available for
reclamation needs to be developed, together with a company plan 23-6
for reclamation and revegetation based on difficult soil salvage.

We hope that your agency will keep these and other problems, of
which we know you are aware, in mind before approving the EIS.

Sincerely yours,

Warren D. Bowman, MD
Warren D. Bowman, MD

Vikki Fenton Bowman
Vikki Fenton Bowman

---

Mt D.S.L.
Capitol Station
Helena Mt 59620
Attn: Jo Stephens

7/2/91

RECEIVED
SEP 1991
STATE LANDS

Dear Ms Stephens:

We've received the E.I.S. for the
East Boulder Project & I wish to submit
the following comments for both myself
and Mr. Arthur Anstett, my husband.

It would seem that the inform-
ation of these documents are vague
in many areas: No specifics are
given for the design of water treat-
ment facilities, weed control programs, 24-1
air pollution control reclamation
plans (2" of top soil inadequate for that area
elevation) water monitoring plans and,
also, busing of miners. That some
of these areas, if accepted, decisions
would be left to the agencies or 24-2
the mine without public review —
that seems improper in our estimation

Possible pollution of the East 24-3
Boulder River, if the petition is allowed
that SPGMR filed to be exempt
from the Mont. Water Quality Act 24-3
non-degradation policy, is unthinkable.
Water is one of Montanas' valuable
resources. Water rights of East Boulder
residents and water users must be con-
sidered and protected. Mining is a 24-4
one time thing and agriculture
is an ongoing thing of many years -
past and future as well as the present.

Water monitoring programs need
clarification as to where, when and how 24-5
often the company and agencies intend to
monitor water quality and quantity.

Because of the present market
climate of platinum is considerable
lower and uncertain, there should be
some time frame as to how long 24-6
a permit for mining should be
considered — does a permit last
indefinitely in case mining is put
on hold?

An alternative should, also, be 24-7

considered when it comes to a single liner for the tailings pond.
The E.I.S even states the proposed liner can possibly leak — perhaps a double liner with a leak detection system should be used under the tailings ponds — certainly a viable option. 24-7

And lastly, a traffic control program needs to be addressed — with definite plans instituted and definitely needed all along the routes used. 24-8

Thank you for your time and attention.

Sincerely

Dolores L. Anstett
Arthur W. Anstett

HCR #59 Box 217
McLeod, MT 59052

---

291

9/4/91

Dear Jo -

I am writing as a resident of Sweet Grass County concerning the EIS for the East Boulder mine.

I feel the information within the draft EIS is too vague. No or only sketchy specifics are given for the design of any water treatment facilities, weed control programs, busing of the miners, air pollution control, reclamation plans, water monitoring plans, wildlife impacts, etc. 25-1

Plans and decisions on all these crucial areas should be spelled out in detail in the EIS so as little as possible is left for the agencies and mine to (P.O.) figure out at a later date on their own. 25-2

It is very important that if and when the mine comes to our County we have the best possible mine we can get with as little negative impact on our residents as possible.

Thank you for considering these issues.

Sincerely,
Francis Blake

---

RECEIVED
AUG 14 1991
STATE LANDS

West Boulder Ranch
Box 65
McLeod, Mt. 59052
August 11, 1991

Ms. Jo Stephens
Montana Department of State Lands
Capitol Station
Helena, Mt. 59620

Dear Ms. Stephens:

The following are my comments as a local resident on the Draft Environmental Impact Statement for the East Boulder Mine.

1) Degradation of the river's water quality is unacceptable.

2) Degradation of the terrestrial ecosystem is equally unacceptable. Any tailings impoundments or other damaged areas should be restored to natural condition. 26-1

3) Both federal and state government agencies should make serious, constant, and careful monitoring of the mine's effects a requirement of any permits issued. 26-2

4) Vehicle traffic should be minimized. Buses and minivans should be the principal means of travel. Private automobiles should be in use only as a last resort, and then only with a minimum of three passengers. 26-3

5) There should be a strictly limited time in which the mining may take place, at the end of which further evaluation should be required before work be allowed to proceed. 26-4

6) Strict measures should be taken to avoid bear attractants at the mine site and along the roads. 26-5

7) I am told that the mine would drain indefinitely. Is it possible in this world to take care of poisoned water _forever_? That sounds most unlikely. What measures would be taken to eliminate permanent pollution caused by drainage? 26-6

8) Are soils available for reclamation? In this area, topsoil is notably scarce. I would urge you to require that sufficient reclamation soil be obtained in advance of the issuance of any permit. 26-7

9) The DEIS does not adequately address the social and economic impacts of the proposed mine--nor of its possible 26-8

sudden closure. It is well known that precious-metals prices fluctuate wildly, and the effect has already been seen at the Stillwater project, in the form of large layoffs. The effects of the introduction of a large number of mining personnel in this remote and peaceful valley would be massive, and they are massively underestimated in the DEIS. The full range of effects on local communities and economic interests must be evaluated in the final EIS, and I believe that those effects will be shown to be overwhelmingly negative. 26-8

Thank you for this opportunity to comment.

Sincerely yours,

Thomas McNamee

---

Farwell Smith
Boulder River Road
McLeod, Montana 59052

SEP 4 1991

Aug 29, 1991

Mr Sherm Sollid
Gallatin N.F
Ms. Jo Stephen
Montana Dept of State Lands

RE: East Boulder Mine Draft E.I.S.

Dear Mr. Sollid and Ms Stephen,

Once again I write regarding the East Boulder mine with particular concern to TRAFFIC.

We strongly advocate an aggressive bussing program - with incentives for workers to bus - and a target of more than 3 passengers per vehicle. The parking lot should be far smaller than 200 places to help enforce this program. Anyone familiar with this area dreads the vision of heavy traffic along the Big Timber - East Boulder Bridge section, and the traffic above the East Boulder Bridge would be frightfully 27-1

crowded. Danger, congestion, dust - all could be mitigated by a reasonable traffic plan. 27-

I was shocked to see that the company seeks an exemption from Montana's non-degradation rules. This is outrageous. A project of this size and with such financial resources should be required to conduct its operations within the legal bounds, and in the full spirit of environmental laws. 27-

Sincerely,

Farwell Smith

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Farwell Smith
Boulder River Road, McLeod, Montana 59052

RECEIVED
OCT 15 1991
MONT. DEPT. OF HEALTH & ENV. SCIENCES
WATER QUALITY BUREAU

October 11, 1991

Dear Mr. Harpestad,

I am writing to ask the Water Quality Bureau to deny the request of Stillwater PGM Resources to allow them to degrade the water of the East Boulder River and therefore the main Boulder River as well. 28

Our water is pristine and must stay so for health, recreation and fishing.

The draft EIS is full of conjecture about what may happen on the East Boulder. It is obvious that a water treatment 28

Facility, a more secure tailings pond, and other steps of this nature will be necessary to keep the East Boulder river safe and useful for us all. 28-2

Sincerely,

FARWELL SMITH

---

SEP 9 1991

Aug 31, 1991

Mr. Glenn Sollid
Gallatin N. F.
Ms. Jo. Stephen
Montana Dept of State Lands

Dear Mr. Sollid and Ms. Stephen,

I am writing regarding the draft EIS on the proposed SPGMR mine up the East Boulder River. I would like to bring to your attention my concerns about the following points.

1) SPGMR should NOT BE EXEMPT from our Montana Water Quality non-degradation policy 29-1 and they should be required to put in permanent monitoring systems 29-2 and adequate bonding to ensure clean up in the event of an accident 29-3

2) We should require very strict standards in the tailings pond and dam areas to minimize the risks of leaking — a problem which occurs frequently at these sites 29-4

3) We need a bussing and/or car parking plan with assurances of implementation, a small parking lot with worker incentives, or a strict mine policy to ensure that the traffic to and from the mine is kept to a minimum 29-5

4) We should not lower our current standards of 2:1 slope on the tailings dam 29-6

5) The mine should be required to reclaim the mine site with topsoil levels similar to what they are now 29-7

6) The draft EIS is entirely too vague as to specific measures for weed control, air pollution control, water monitoring and/or purification, and traffic restrictions. 29-8 We need to minimize the impacts on the quality of life of the human AND wildlife residents of the area while we focus on the environmental resource quality issues. 29-9

Sincerely
Linda McMullen

Box 64
Mcleod MT. 59052

---

RECEIVED
OCT 1 0 1991
STATE LANDS

October 6, 1991

Jo Stephen
Department of State Lands
Capitol Station
Helena Mt 59620

Dear Ms. Stephen :

I am writing again to express my concerns on the Draft EIS on the East Boulder Mine (SPGMR platinum/palladium mine). I am seriously upset by the trend for hard rock mining companies to seek exemptions from Montana's non-degradation policy (Section 75-5-303) and in doing so they fail to consider viable alternatives to polluting our pristine waters. Permitting the East Boulder project without requiring the best available technology that would prevent degradation violates the non-degradation policy of both the Montana Water Quality Act and the federal Clean Water Act.

According to the National Environmental Policy Act (NEPA), the goals of an EIS (Environmental Impact Statement) are to develop alternatives which do not degrade the present environment. A mining project of this magnitude will have a definite deleterious effect on the environment unless extraordinary measures are taken to mitigate these effects. This draft EIS has not adequately developed alternatives to violating the anti-degradation standards. Nor has it presented adequate data and information to substantiate its claims on water quality and environmental safety. Please accept the following comments for the record. 30-1

1. It is a hypothetical assumption (not substantiated with data) that the mine water discharge, waste rock composition, tailings pond chemistry and sediment and nitrate and nitrite levels will be the same on the East Boulder as they are at the Stillwater mine. This means that all strategies put forth using this assumption have room for incalculable error. 30-2
2. The DEIS needs to describe water treatment strategies and facility design in case it is deemed necessary to treat mine discharge water, tailings pond overflow water, tailings pond leak collection system, run off from waste rock piles or septic system water. 30-3
3. Specific monitoring sites need to be designated and described in a monitoring plan which tests surface as well as groundwater. The water should be checked at least monthly with monthly reporting to state agencies. We need to monitor the East Boulder River above the mine and at points below the mine discharge areas. Mine discharge water, waste rock run off, designated wells near the mine site, wells located "down aquifier" and sites around the tailings impoundment should all be tested regularly to detect problems early. 30-4
4. There should be surface and underground monitoring around fuel and reagent transfer areas. Physically contained areas would be beneficial to prevent ground and surface water contamination. 30-5
5. There is no plan to mitigate possible deleterious effects of waste rock piles. 30-6
6. There is no plan to install runoff control devices such as berms and drains to prevent sediment loading or accidental spills into the river. 30-7
7. The DEIS needs to develop a better plan to reclaim the slope on the tailings impoundment. Some data suggests that the 2(H):1(V) slope is not easily reclaimable. Why not require a more gradual slope? The 1.6:1 slope proposal is unacceptable. 30-8

8 A specific plan is needed to build a permanent berm around the tailings impoundment to divert surface water around it. Also, is there a need for a fence around it to protect wildlife? **30-9**

9. What is the plan in the event that the tailings impoundment overflows? **30-10**

10. The plan to minimize leakage of the tailings impoundment by using just one layer of 100-mil high-density polyethylene is inadequate. There is no plan suggested to attempt to mitigate leaks through collection or prevention. Why not usde a layer of bentonite and a drainage/leak collection system (which would run directly into water treatment facilities) under the impoundment? Why not use two layers of plastic with a "shock" layer between them? With bentonite under the whole works? Why did this DEIS address potential solutions to the leakage problem with one layer of plastic? **30-11**

11. A leak detection system should be installed beneath the impoundment as an integral part of the leak collection system to identify problem areas of the impoundment. **30-12**

12. No road route was selected, no specific power corridor mentioned, no specific road paving project to straighten and widen the road is mentioned No busing plan proposed, no specific weed control measures revealed and no plan for dust control. All of these areas need to be addressed with a specific plan so that there can be a public comment period to evaluate the proposals. **30-13**

13. We need to be specific about the Trust Fund in Perpetuity (mentioned on page 1-4 of the draft DEIS) which is in addition to the reclamation bond, required. This is to be set up for perpetual maintenance and treatment costs - for sedimentation/percolation pond maintenance, water treatment facility, berm maintainence, mine water discharge or waste rock water treatment, which may be necessary after the mine closes. **30-14**

14. We need data to support the belief that a post-mining water treatment proposal of 14 years is sufficient to protect the surface and ground water quality in perpituity. **30-15**

15. We should be able to examine some current reclamation cost estimates against estimates for 25 years in the future. We need approximate bonding requirements. Also realistic figures for the Trust Fund in Perpituity are necessary to ensure that the environment is protected in the event of a long term (more than 14 years) water treatment and/or sediment removal program. **30-16**

16. SPGMR should not be exempt from Montana's non-degredation rules with regard to surface and groundwater discharges. The company has not fully examined alternative measures that they could take to prevent degradation of the presently pristine water of the East Boulder River. **30-17**

17. The mine is proposing a 200 vehicle parking lot. The impact of the large number of vehicles implied by a lot of this size is both socially and environmentally unacceptable. It would result in excess dust control measures, road maintainance, noise, and the considerable inconvenience of overcrowding 27 miles of roadway which is at best only a two lane road. Road safety considerations are of particular concern. The Stillwater mine goal of 2.5 riders per vehicle (not including management) is inadequate for this valley where there are more employees and only one access road. We need figures revealing estimated number of service vehicles per day, visitor traffic projections and a busing plan which has a goal in excess of 5 riders per vehicle, management included. A parking lot of approximately 75 vehicle capacity will give impetus to adopting and maintaining a sound plan of this nature. **30-18**

Historically, hard rock mining has had a poor environmental and social record. With this SPGMR East Boulder mine we have an opportunity to set a standard for environmentally sound mining practices which will not degrade our water quality, where each impact of the community and environment is thoughtfully mitigated by a carefully thought out set of viable alternatives which will avoid the degredation so typical of the extraction industries of the past and present. I urge you to consider addressing these concerns in the next EIS. There is nothing more important to all of us than a healthy unpolluted environment in which to live and raise our children. Let's work together to try and keep the East Boulder drainage that kind of place.

Very Sincerely,

Linda McMullen

Linda McMullen
McLEod MT 59052

# COOKE CITY STORE

Northeast Entrance to Yellowstone Park
General Merchandise Since 1886
Box 1097
Cooke City, Montana 59020
(406) 838-2234

RECEIVED
SEP 9 1991
STATE LANDS

September 4, 1991

Dear Jo and Sharon,

I'm commenting on the East Boulder Project since our community is facing a similar proposal. We share similar concerns about the adequacy of what the companies propose for mitigation measures. The following are my concerns:

1) I encourage the state to disallow an exemption for degradation of water quality. If companies are allowed to continue to mine in Montana it seems only fair the state should enforce strict water quality standards, ensuring that our state has healthy groundwater for future generations. **31-1**

2) Effective monitoring for groundwater and for stability of the tailings impoundment should be specified and required by the agencies. **31-2**

The preferred slope of the impoundment should be 2:1. **31-3**

If dewatering the tailings would make them more stable, I support the measure. **31-4**

3) The agencies must require an adequate bond for successful reclamation and water treatment into perpetuity. Once again, if companies are allowed to mine in Montana they must be held to the responsibility of total, successful reclamation. **31-5**

The taxpayers and the state must not be stuck with the companies' failures. The provisions for successful reclamation must be clearly spelled out and the bonds must be sufficiently high to ensure the companies will do a commendable job. The reclamation plan should include a careful estimate by SPGMR and the agencies of how much soil can be salvaged for revegetation and reclamation. **31-6**

4) A time frame for revision should be a stipulation in the EIS should SPGMR put off development due to unfavorable market conditions. **31-7**

5) Strict carpooling measures, adequate buses, and a smaller car lot at the mine for parking to discourage single occupant cars should be a major mitigation measure by SPGMR to show local citizens that SPGMR is a responsible neighbor who wants to help minimize impacts to wildlife and citizens who live on the East Boulder. The companies could institute incentives to workers to ensure the success of busing and carpooling. **31-8**

6) Animals killed should be removed from the area so that scavengers will not be unnecessarily drawn to the area. Human/bear encounters should be kept to a minimum by keeping a very clean work area and by removing road kill. **31-9**

I encourage the agencies to insist on the highest quality mine project possible on the East Boulder. The companies will get their share of profits and the community will get something in return — a guarantee that the project will not negatively impact it for many years to come.

Sincerely,
Sue Glidden

## COOKE CITY STORE

*General Merchandise Since 1886*
Box 1097
Cooke City, Montana 59020
(406) 838-2234

September 5, 1991

Mr. Jo Stephens
Montana Dept of State Lands
Capitol Station
Helena, MT 59620

Dear Jo,

Thank you for this opportunity to comment on the Draft Environmental Impact Statement for the proposed platinum/palladium mine to be operated by Stillwater PGM Resources along the East Boulder River south of Big Timber.

The preferred alternative includes many excellent mitigation measures, particularly in regard to potential negative impacts to wildlife and the reduction of noise pollution. However, other areas need to be strengthened. Please consider the following recommendations:

1) The company's intention to petition for exemption from the states water non-degradation rules should be clearly refused in advance. **32-1**

2) I support the agency proposal for a slope of 2:1 for the tailings impoundment because it would provide more stability, less visual impact, and better prospects for reclamation and revegetation than does SPGMR's proposed 1.6 : 1. **32-2**

3) Dewatering of the tailings mass should be required, and reclamation and bonding requirements established to ensure site stabilization, and restoration to pre-mining land use conditions. **32-3**

4) A time limit should be placed on the permit and the validity of the EIS analysis if development is delayed. **32-4**

Thank you for your consideration.

Sincerely,
Ralph Glidden

---

*William Reinhold Hjortsberg*
*Main Boulder River Route*
*McLeod, Montana 59052*

September 5, 1991

MT DSL
Capitol Station
Helena, MT
59620

To Whom It May Concern:

I have just spent some time studying the draft EIS for the East Boulder Mine Project, (as well as the recently mailed supplement,) and I am quite concerned by the vagueness of the language with regrad to many of issues under review. As a professional writer for the past twenty-five years, I believe I've learned a bit of the sleight-of-hand that can be achieved with a deft turn of phrase. Or, more to the point, buried under a mountain of dull official prose with accompanying charts and graphs.

The reality of the situation is that the SPGMR has petitioned the state for exemption from the Montana Water Quality Act non-degradation policy. In the face of these obviously stated intentions to pollute the East Boulder River with official sanction, it seems that the draft EIS is inadequate in addressing the problems of maintaining and monitoring water quality on the East Boulder. I can find very little concerning the planning for water monitoring in the EIS. **33-1**

I'm also worried about existing water rights and the 5 cubic feet per second minimal flow levels requested by the company. Does the company have the right to file on water rights that they may tap into underground at the head of the drainages? And should the company be allowed to use all the water down to a bare minimum flow every year? **33-2**

I also believe a comprehensive bussing plan should be included in the EIS. And, in accord with this, the size of the sited parking lot should be decreased. **33-3**

The tailngs pond is located 100 feet from the East Boulder. Since the EIS states that the proposed lining system will leak, is this not a good arguement in favor of the EIS specifying a double liner with a proper detection system for leaks? **33-4**

On the plus side, the EIS proposal for a more stable 2:1 slope for the tailings pond is step in the right direction. **33-5**

As for reclamation: the proposed two inches of top soil is entirely inadequate. One windy day, (and any resident of the area can comment on the frequency of high winds,) would remove such scanty cover. Existing soil levels are well over six inches, why should not the reclamation properly replace what they've used. Also, the reclamation must be proved to be a success before the mine company is released from its reclaimation bond. **33-6**

Sincerely,
William Hjortsberg

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To Whom It May Concern- (14)

I am writing in regard to the meeting at the courthouse to accept public testimony concerned with the draft EIS for the Stillwater PGM Resources East Boulder Project.

My family and I lived in Arizona for 6 years and witnessed, first hand, the kind of devastation that mining can create. I am including underground and pit mining, small scale, large scale, old-time, abusive, out-dated practises, as well as current, state of the art mining technology, tailings heaps and leach ponds, mills, smelters, concentrate production and transport, air and water quality control standards, shift traffic, boom and bust cycles, adverse effects on agriculture, and what I call the mining mentality.

I had many friends that were miners. I worked for a mine, myself, for a year and a half. I'm not putting miners or mining down. Most miners are fine people and I respect the profession, but I will admit to an anti-mining bias that developed as a direct result of my involvement with, and our observation of, the mining industry and it's accompanying attitudes.

I won't elaborate on those attitudes except to say that there are fundamental differences in the way mining exploits it's resources, compared to the aproach of industries involved with renewable resources where the degree of development, as well as methods employed in production, directly affect the health of the industry and future production.

I believe mining could be compatible with agriculture, wildlife, recreation, and

Sweet Grass County, but my experience is all to the contrary. I'm afraid the long-term costs of this project could easily outweigh any short-term gains to the community.

It is common practice for a mine to do it's own air and water quality monitoring. A friend in Arizona was employed by a mine to take regular air pollution readings on it's smelter, in compliance with state law. When the readings were too high and she radioed the plant to cut back, they laughed at her. The state inspector rarely levied a fine, and if he did it was negligable, compared to the profit in pollution. My friend had to leave the job because it left her with such a sick feeling. The smelter continued to break state air quality laws for the next five years. **34-1**

I don't think the honor system is workable where greed and profit are involved, so I would not want the mine to do it's own water quality monitoring, nor do I want to see a permit issue with an expectation of anything but zero water pollution. If the industry does not currently have the technology to exploit the ore body without degradation to ground water, let the permit wait until it does - the minerals will still be there! **34-2**

At the very least, make certain that the costs to the mine for violations and non-compliance are far greater than the costs of compliance. Don't asume the mine will do the right thing - insist on it, economically, because that is the bottom line - profit or loss, and I think the Forest Service owes it to the country and the community to make absolutely certain that Mining doesn't take the Profit and leave us with the Loss! Thank you for your time. **34-3**

Sincerely,
Dave Gains, Rancher, Melville

October 9, 1991

Box 1336
Big Timber, MT
59011

MT Dept. of State Lands
c/o Jo Stephen
Capitol Station
Helena, MT 59620

Dear Jo,

I am a resident of Big Timber. I am concerned about SPGMR's request to seek exemptions from Montana's nondegradation policy.

I was born and raised in South Dakota. I spent a numbers of years pursuing a career on both coasts. I took a cut in salary and benefits to move to Montana yet I never once regretted it.

I was attracted by the friendly honest people and the pristine beauty of the area. I am proud of the fact that some of the best fly fishing in the lower 48 is right here on The Boulder River.

No degradation of the existing high quality of the Boulder should be allowed! How can we be sure what quantity of pollutants is safe for humans and wildlife. In addition, how can we be certain that these limits will not be exceeded? 35-1

No one had any idea how rapidly and to what extent domestic wells around the Shoemaker mine near Lewistown would become contaminated by Blue Ridge Mining Company's tailings. How can we be certain catastrophes of this sort won't happen here? 35-2

Long after the mine has closed and the economic boom has dissipated, contaminants will still be leaching into the Boulder River. What gives us the right to claim the benefits and leave a degraded river for future generations? 35-3

Please choose alternative 6(a) in the draft EIS of The East Boulder Project.

Sincerely,

Quintin Ehley

---

Steve & Susan Pauli
P.O. Box 582
Big Timber, MT 59011

October 10, 1991

TO WHOM IT MAY CONCERN:

As residents of Sweet Grass County and business people of Big Timber, we are very concerned about what may happen to this community should SPGMR be allowed to begin mining on the proposed East Boulder Project. Also, in light of recent news that the Governor of Montana has written letters to various agencies in order to expedite the issuance of permits allowing companies in Northwestern Montana to be exempt from the nondegradation policy of the Montana Water Quality Act, we feel it necessary to comment.

In April of this year, SPGMR petitioned the Montana Board of Health in order to be allowed to discharge contaminants into the groundwater and directly into the East Boulder River. (The East Boulder River is a direct tributary to the Main Boulder River, from which the City of Big Timber obtains its drinking water.) This is an outrage, and is in direct violation of the Montana Water Quality Act. Exemptions are made and granted based on "...necessary economic and social development". No amount of money or progress can replace the quality of a pristine stream once it is contaminated by chromium, lead, nitrates, and other such pollutants. 36-1

The people of this community and State should be strong, and should demand that the government of this State be responsible and uphold to the best of their knowledge and ability the laws of this State. It is their duty and obligation to protect and prevent degradation of our natural resources.

As citizens of this community and State, we have the right to clean air and water, for ourselves and for our children.

We support and demand that any considerations by SPGMR to in any way degrade the water quality and/or environment of the East Boulder be stopped. It is possible that the company, without affecting the project, can fully treat the effluent, thus protecting the pristine water quality of the East Boulder River. 36-2

We believe that before this project is allowed to progress, every precaution must be taken to the fullest extent to protect the East Boulder. Resolutions concerning upholding water quality, road access, bussing of workers, and reclamation for the tailings pond should be resolved to the highest standards before the issuance of any and all permits. 36-3

Montana is a beautiful State, the East Boulder is an ideal of that beauty - don't let it be ruined by lack of foresight, or by the desire to have a speedy and unquestioned progress.

Sincerely,

Steve Pauli

Susan Pauli

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SALLY GINGRAS
Architect
1120 North Olive Avenue
West Palm Beach Florida 33401

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October 10, 1991

Ms. Jo Stephen
Montana Department of State Lands
Capitol Station
1625 Eleventh Avenue
Helena, Montana 59620

RE: Draft Environmental Impact Statement
East Boulder Mine Project

Dear Ms. Stephen:

As a landowner in the Lower Main Boulder River Valley, I would like to make the following observations regarding the Draft Enivronmental Impact Statement for the East Boulder Mine. I understand that the deadline for comments has been extended to October 15, 1991. My comments are limited to Chapter Two, the description of the applicant's proposal and the Agencies' preferred alternative, and to Chapter Four, Impact Summaries.

page 2-5
Table 2.1-1 identifies the tailing dam slope for Alternative 7 as 1.6:1, the same as Alternative 2. It is unclear whether or not the Agencies prefer the 2:1 slope proposed in Alternative 3. This is definitely a more desirable solution to the situation. 37-1

page 2-15
2.3.2
Alternative 2 proposes mine production levels of 730,000 tons per year. There is no indication that the Agencies have studied alternative production limits. It is also unclear if the SPGMR would be allowed to increase production beyond that limit if it chose to. 37-2

page 2-18
2.3.3.2
Future modifications to the reagents and their dosages should be reviewed and monitored by the Agencies to insure that changes would not result in detriment to the environment. 37-3

page 2-20
2.3.4.1
Tailing water concentrations of reagents seem to be calculated for water that has passed through the system once, yet this water is to be recycled. Would this result in higher reagent concentrations? 37-4

page 2-23
2.3.4.1
The Agencies should supervise the placement of the impoundment liner. Quality control would certainly improve if a double liner were required as well as a seepage detection system. 37-5

page 2-26
2.3.5
SPGMR expects a total waste rock prodution of 7,290,000 tons, yet the 37-6



waste rock storage area (pg 2-37) has been designated to hold only 150,000 tons. Does SPGMR expect to use 7,140,000 tons for construction? If not, where would the excess be placed, and what plans have been made for reclamation? 37-6
What volume of waste rock is expected to end up in the Frog Pond waste rock dump, and what plans for reclamation of that area have been submitted? 37-7

page 2-28
2.3.6.3
Why has a provisional permit for groundwater extraction has been granted before the actual mine permit has been fully evaluated? Studies should be done to determine whether or not this will affect water rights in drainages below this area. 37-8

page 2-28
2.3.6.4
Water disposal methods include two alternatives to disposal in the ponds: spray evaporation and irrigation. It is unclear whether the environmental impacts of these alternatives have been considered. If these alternatives are not used, and all the water goes into the ponds, that totals 183,000,000 gallons per year. Are the ponds capable of handling this load? If not, where would the water go? 37-9

page 2-30
2.3.6.5
Why was SPGMR data on water quality taken for only one month? Was that a typical month for Stillwater mine operations? If not, the data could change significantly. 37-10

page 2-34
2.3.9.2-.3
Specific limits should be placed on the amount of helicopter traffic to Placer Basin and Brownlee Creek and the time of day when flights may be flown. From where do the helicopter flights originate? The impact of noise from these flights could be significant to Boulder Valley residents and has not been addressed. 37-11

page 2-38
2.3.12.2
Quantities of explosives to be stored on site should be specified, as well as storage area designs to minimize damage from accidental explosions. 37-12

page 2-39
2.3.12.2
If a busing plan is to be implemented, there should be no need for parking for two hundred cars. If parking is available individuals will invariably use their own cars. The size of the lot and the number of cars allowed in the permit area should be strictly limited. 37-13

page 2-44
2.3.16
How much solid waste is anticipated for disposal in the Sweet Grass County Landfill? Has this been calculated in addition to the increased requirements for new employees and their families to determine the overall impact on the life of the Landfill? 37-14

page 2-45
2.3.18
Specifics should be given for the sizes and types of trucks and service vehicles and the times during the day when they will be using SG31, FAS298, and McCleod Street. Plans for upgrading roads should be submitted and approved before any permits are issued. A complete busing plan should also be approved before permitting. Traffic increases would be among the most severe impacts on existing residents and should be carefully evaluated and mitigated. **37-15**

page 2-47
2.3.19.5
It is unclear if the Agencies or SPGMR are to do the environmental monitoring. Water quality monitoring is proposed to be done every three months and reported annually. A great deal of damage can occur within this time period. Specific plans should be developed for all monitoring before permitting. **37-16**

page 2-59
2.3.20.8
There seem to be conflicting estimates of how much soil will be available for reclamation uses (4.2.2) How much coverage will be required? Proposed depths of 2" seem ridiculously inadequate. **37-17**

page 2-73
2.4.4
Alternatives 6A, 8, & C, do not include any descriptions of the sizes, locations, or designs of the water treatment facilities. It would seem that this information would be essential in making a decision about which alternative would have the least environmental impact. **37-18**

page 2-80
2.5
40CFR 1508.20 is quoted "...mitigation may include...compensating for the impact by replacing or providing substitute", and the following example of destroyed wetlands refers to "compensation" type mitigation as "creating habitat elsewhere in quantity equal to or greater than that to be destroyed." (emphasis added). Alternative 7 appears to ignore this concept. No where is SPGMR required to do more than attempt to minimize environmental disturbance. In other areas of this country, if one acre of wetland, to use the EIS example, is destroyed, the developer is required to replace that with three acres elsewhere. The Agencies should examine this concept carefully and determine what additional compensations would be appropriate. **37-19**

page 2-81
2.5.1
This section appears to address only the main adit. Will the adits at higher elevations be plugged? If not, where will the water drain? **37-20**

page 2-81
2.5.2
Surface water control systems should be designed and approved before permitting. **37-21**



page 2-82
2.5.4
The impact of maintaining " historic minimum flows" year after year after year on the East Boulder should be very carefully examined, from the standpoint of both the aquatic environment and the needs of residents downstream. **37-22**

page 2-83
2.5.6
As indicated above, specific plans for busing, road upgrading and maintenance, as well as various control policies should be in place before permitting. **37-23**

page 2-84
2.5.7
Waste rock management plans should be in place before permitting. Who monitors this? **37-24**

page 2-86
2.5.13
This section is entirely too vague considering the impact that a 140 foot high tailing impoundment would make on the "visuals" of the area. The vegetation management plan should be spelled out. Perhaps this is an area where the issue of additional compensation could be addressed. **37-25**

page 2-86
2.5.14
Upgraded muffling systems should be required and monitored on ore trucks and all other mining vehicles travelling up and down the Boulder Valley. Debicel readings should be taken at various points along the Valley. The shape of the valley has an effect on whether engine and tire noise is dissipated or amplified. **37-26**

page 2-88
Figure 2.6-1 identifies two (presumably) mining projects, M7 and M8, which are not listed in the discussions. What is the status of each of these projects, and will they contribute to cumulative environmental consequences? **37-27**

page 4-124-131
4.16.2 & 4.16.7
The Impacts Summary for Alternative 2 lists fifty nine potential impacts. Alternative 7 states: "The proponent's proposal is modified under this alternative by the incorporation of several measures and requirements designed to mitigate environmental impacts. The potential remaining impacts may include:..." A list of seven impacts follows. This implies that all fifty two of the other impacts have been mitigated by Alternative 7. The following is a list of impacts not addressed at all in Alternative 7: **37-28**

- -Physical or visual alteration of cultural resource properties may occur.
- -Intentional collection and destruction of cultural material may occur...
- -Unintentional disturbance of unstable land forms which contain buried cultural resources...may occur.
- -Temporary increases in runoff and erosion during facilities construction



periods could result in a 5-7% increase in sediments carried by the East Boulder River.

- -Increased flows in the East Boulder River could result...ultimately altering the River's channel shape.
- -Percolation ponds could clog over time, and mitigation measures would be required to prevent overflow.
- -Detrimental flow reduction in the East Boulder River could occur between the permitted surface water withdrawal point and the area of river water recharge from the percolation ponds.
- -Some additional sediment loading could occur during facilities removal associated with mine closure.
- -Loss of approximately 233 acres of vegetation and wildlife habitat.
- -Temporary displacement of elk from small portions of summer/fall use habitat areas on the East Boulder Plateau.
- -Up to 10 acres of mule deer wintering habitat may be lost.
- -Some displacement of local deer away from traffic areas, resulting in indirect loss of summer and winter habitat.
- -Minor loss of white tail deer year round habitat in areas of SG31 upgrade.
- -Some displacement of moose during construction activities, and minor alterations of moose habitat in the Placer Basin Permit Area.
- -Loss of black bear habitat in the East Boulder Permit Area and an increased potential for human/black bear interactions.
- -Minor habitat loss for other species, including raptors, upland game, and mountain lion.
- -Localized impacts on brown trout and rainbow spawning areas could result from sediment increases near bridge upgrades. **37-28**
- -Withdrawal of surface water during low flow periods could adversely impact fisheries...
- -The Main Boulder River would likely see increased fishing pressure, with much of the increase concentrated on publicly accessible fishing areas.
- -Increased fishing pressure on the East Boulder River could strain local fish populations.
- -Approximately 200 acres would be removed from timber production.
- -Air quality would be degraded over existing environment due to increases in particulate and gaseous emmissions.
- -Alterations of land use patterns by full and part-time residents of the East Boulder Valley could occur due to increased traffic, noise, etc.
- -Some change in timber management would occur...
- -Land use patterns in nearby communities and rural areas near the permit area may change due to increased residential and commercial development.
- -Moderate and short term visual impacts would be caused by reconstruction activities along the Main and East Boulder Rivers...
- -Big game species distribution may be altered and less common...
- -The Absaroka-Beartooth Wilderness could be impacted by noise...
- -Recreational activities would be changed...
- -Hunting pressure would likely increase...
- -Noise impacts are expected from...commuter and access road traffic.
- -Noise generated by adit ventilation fans may be audible in the Absaroka-Beartooth Wilderness.
- -Population migration into Sweet Grass County would increase 38%...



Clearly, a great deal of effort has gone into compiling the list of impacts. While some of them may seem trivial, taken together they represent an enormous set of changes to the environment. Each and every one of these impacts should be carefully examined and mitigation measures specified. If no mitigation solutions exist, then consideration should be given to each irreversible impact when deciding whether or not a permit will be issued. **37-28**

As a final comment, the General Mining Law of 1872 refers to valuable mineral deposits being open to exploration and purchase. Given the current price of platinum and palladium on the world market, SPGMR should be required to prove that they can profitably operate this mine. No corporation or individual should be given license to devastate the environment to suit their own internal business plan. If a permit is to be granted, certainly a time limit for reaching full production should be required. **37-29**

Sincerely,
Sally Gingras
Sally Gingras, A.I.A.

cc: Mr. Sherm Sollid
Gallatin National Forest

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Oct 10, 1991

Dear Jo,

We are very concerned about degradation of the East Boulder and hope you will seriously consider Alternative. 38-1

We would also hope for housing for the 600 mine workers, 38-2 a resolution of the road access issue before the 38-3 permit is granted. and a reclamation plan for the tailings pond. One that will work. 38-4

Thank you for your consideration

Sincerely,

Jane W. [illegible]

[illegible]

---

Mt. Dept of State Lands
c/o Jo Stephen
Capitol Station
Helena, Mt. 59620

We are absolutely against any degradation of the East Boulder river by ASARCO/MR. The Alternative 6H in the draft EIS should be chosen. (the one dealing with tailings facility allowing no degradation!) 39-1

Also, there should definitely be housing for the 600 mine workers. 39-2

There should be a resolution of the road access issue before the permit is granted. 39-3

There should be a workable reclamation plan for the ~~[illegible]~~ tailings pond. 39-4

Jim [illegible]
Barb [illegible]

[illegible]

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October 18, 1991 — OCT 21 1991 STATE LANDS

Letter Commenting on Draft EIS by Linda Iverson

Enclosed are copies made of the "Vegetation" and (timber and wetlands) "Soils" sections from chapters Three and Four of Draft EIS. Also included is Section on Reclamation from chapter Two.

I wrote my comments directly on the copies so as to show exactly where I have questions. ~~comments~~ I hope this is not too confusing but much of it is due to the discrepancys found in each chapter's section.

The main problems I found in these sections were:

1. If pre-existing conditions are to be restored to the disturbed areas I feel there needs to be a clear idea of what vegetation ~~exe~~ is presently growing in these areas. How many acres in each area will be have vegetation removed? all the plant habitat areas are listed but nothing tells ~~or~~ me where they occur in relation to the disturbed areas. There is no "map" in the document or any reference to where we could look at one. For each area where vegetation will definately be removed I believe that a complete plant species list should be required in chapter Three. 40-1
2. With the above info ~~&~~ I can compare the existing conditions with the reveg. mixes recommended in chapt. Two. Does the veg mix adequately replenish the existing species to the disturbed areas at the time of closure plus the topsoil stockpiles + other on-going reveg projects during the life of the mine? Of special concern are ~~w~~ is whether non-native species should be used at all. 40-2
3. No list of a reveg. mix for wetland areas when it is indictated that wetlands will ~~be~~ require replacement. 40-3
4. The Placer Basin area differs greatly in many ways from the lower elevation mine site + tailings pond. Why do practically the same species lists exist for reveg of both these areas? 40-4
5. Because soil is so important in successful reveg efforts I felt these two areas of the EIS should be studied together. I found much discrepancy in the amt of soil available for reclamation of all the disturbed sites. Little is discussed about compaction. Will the rocks be separated in the begining or sit in stockpiles with the soil. What is the effect of mixing topsoil + subsoil. 40-5
6. Little discussion of reveg success, impacts of a failure, time needed for complete reveg + monitoring the growth after one year. 40-6
7. No reference as to where the soil survey info is. No talk of monitoring soil fertility 40-7

in stockpiles and the need to add nutrients after 25 yrs of settling + leaching 40-7

3. No talk of weed control of reclaimed areas after mine closure. 40-8

I realize that reclamation research is continually bringing up new information + procedures + I hope that the mine will be using the state of the art technology when 27 yrs is up but the baseline info is very vague + I would like more emphasis put on strong requirements right now. 40-9

other areas I am concerned over:

1. I strongly support proposal 6(a) requiring treatment of discharges to prevent degradation of the E. Boulder River's high quality water. 40-10
2. I would like to see a detailed bussing plan included in the EIS + info comparison data on effects of a bussing plan on traffic compared to no bussing. 40-11
3. Compare effects of a decreased parking lot area to the one proposed 40-12
4. I would like to see a resolution of the road access issue before the permit is granted 40-13
5. I would like more comparison data on Alternative 3 in chapter 4 Vegetation section. 40-14

TABLE 2.3-10A
LOW ELEVATION REVEGETATION MIXTURE SEEDING RATES (PLS)*

| Species | Common Name | Preferred Variety | Pounds/Acre | PLS/Sq.Ft. |
|---|---|---|---|---|
| Grasses: | | | | |
| Agropyron riparium | Streambank wheatgrass | Sodar | 3.0 | 11 |
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 2.0 | 7 |
| Agrostis alba | Redtop not native | – | 0.1 | 11 |
| Bromus marginatus | Mountain brome | Bromar | 4.0 | 8 |
| should use Idaho Fescue Elymus cinereus | Basin wildrye | Magnar | 2.0 | 6 |
| Festuca ovina | Sheep fescue | Covar | 1.0 | 16 |
| Poa compressa | Canada bluegrass not native | Reubens | 0.2 | 11 |
| Stipa columbiana[b] | Columbia needlegrass not native | – | 2.0 | 7 |
| Forbs:[c] | | | 1.0-2.0 | 20 |
| very aggressive in seed mix Achillea millefolium | Yarrow | – | | |
| Epilobium angustifolium | Fireweed | – | | |
| different germination Geranium viscosissimum | Sticky geranium | – | | |
| Linum lewisii | Lewis flax | Appar | | |
| not native Trifolium hybridum | Alsike clover | – | | |
| | | Total Seeded | 15.3-16.3 | 97 |

Very few forbs

40-15

- [a] Rates given are for drill seeding; rates would be doubled for broadcast seeding; PLS = Pure Live Seed.
- [b] If unavailable, Stipa viridula would be substituted at a rate of 2 pounds plus PLS per acre.
- [c] Rates given for forbs are for a combination of any or all species listed depending on availability.



TABLE 2.3-11
UPPER ELEVATION REVEGETATION MIXTURE SEEDING RATE (PLS)*

| Species | Common Name | Preferred Variety | Pounds/Acre | PLS/Sq.Ft. |
|---|---|---|---|---|
| Grasses: | | | | |
| Agropyron riparium | Streambank wheatgrass | Sodar | 4.0 | 14 |
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 2.0 | 7 |
| non-native Agrostis alba | Redtop | – | 0.1 | 11 |
| Deschampsia caespitosa | Tufted hairgrass | – | 0.3 | 17 |
| Festuca ovina | Sheep fescue | Covar | 1.5 | 23 |
| Poa alpinum[b] | Alpine bluegrass | – | 0.5 | 11 |
| same as lower elevation ? | | | | |
| Forbs[c] | | | 1.0-2.0 | 20 |
| Achillea millefolium | Yarrow | – | | |
| Epilobium angustifolium | Fireweed | – | | |
| Geranium viscosissimum | Sticky geranium | – | | |
| Linum lewisii | Lewis flax | Appar | | |
| non-native Trifolium hybridum | Alsike clover | – | | |
| | | Total Seeded | 9.4-10.4 | 103 |

40-16

- [a] Rates given are for drill seeding, rates would be doubled for broadcast seeding; PLS = Pure Live Seed.
- [b] If unavailable, Poa compressa would be substituted at a rate of 0.2 pounds PLS per acre.
- [c] Rates given for forbs are for a combination of any or all species listed depending on availability.

Source: SPGMR Plan of Operations 1990



TABLE 2.3-12
SCREE SLOPE REVEGETATION MIXTURE SEEDING RATE (PLS)*

| Species | Common Name | Preferred Variety | Pounds/Acre | PLS/Sq.Ft. |
|---|---|---|---|---|
| Grasses: | | | | |
| Agropyron riparium | Streambank wheatgrass | Sodar | 6.0 | 22 |
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 4.0 | 14 |
| non-native Agrostis alba | Redtop | – | 0.2 | 22 |
| non-native Festuca longifolia | Hard fescue | Durar | 1.5 | 20 |
| non-native Poa compressa | Canada bluegrass | Reubens | 1.0 | 11 |
| same as lower elevation? | | | | |
| Forbs[b] | | | | |
| Achillea millefolium | Yarrow | – | 0.1 | 6 |
| Linum lewisii | Lewis flax | Appar | 1.0 | 7 |
| need more variety | | | | |
| Shrubs: | | | | |
| Juniperus communis | Common juniper | – | 1.0 | 1 |
| Ribes aureum | Golden currant | – | 0.5 | 4 |
| Rosa woodsii | Wood's rose | – | 1.0 | 1 |
| Rubus idaeus | Raspberry | – | 0.5 | 4 |
| Trees: | | | | |
| Abies lasiocarpa | Subalpine fir | – | 3.0 | 3 |
| Pinus contorta | Lodgepole pine | – | 2.0 | 4 |
| Pseudotsuga menziesii | Douglas-fir | – | 3.0 | 1 |
| | | Total Seeded | 24.8 | 122 |

40-17

- [a] Rates given are for drill seeding; rates would be doubled for broadcast seeding; PLS = Plus Live Seed.
- [b] Rates given for forbs are for a combination of any or all species listed depending on availability.

Source: SPGMR Plan of Operations 1990

## TABLE 2.3-13

## INTERIM REVEGETATION MIXTURE SEEDING RATE

| Species | Common Name | Variety | Pounds/Acre | PLS*/Sq.Ft. |
|---|---|---|---|---|
| Agropyron trachycaulum | Slender wheatgrass | Revenue | 2.00 | 7 |
| Agropyron riparium | Streambank wheatgrass | Sodar | 4.00 | 14 |
| Agrostis alba non-native | Redtop | -- | 0.10 | 11 |
| Dactylis glomerata non-native | Orchard grass | Paiute | 1.00 | 15 |
| Phleum pratense non-native | Timothy | Climax | 0.50 | 15 |
| Poa pratensis non-native | Kentucky bluegrass | -- | 0.25 | 12 |
| Trifolium hybridum non-native | Clover | -- | 1.00 | 16 |
| | | Total Seeded | 8.85 | 90 |

* PLS = Pure Live Seed

Source: SPGRM Plan of Operations 1990

the key. viable?

40-18





Planting ratios, particularly of tree species, vary from pre-mine conditions to reflect commercial value of the species. Recommended planting ratios may vary depending on slope, aspect, and moisture conditions. It is expected that a certain amount of natural regeneration of tree species would also occur on those sites abutting existing stands. The decision to use containerized or bare-root stock would be based on species, site characteristics, growth medium and substrate season of planting, availability, and cost. SPGMR would investigate the possibility of collecting tree and shrub seed on site to produce genotypically similar stock. Stock would be delivered to the site as close to the time of planting as possible. No stock would be handled when the air temperature is below freezing and no plantings would be made when frost is in the soil. Planting would be accomplished using hand tools and power-driven augers or other machines, depending on size and condition of the planting area, type of stock, and equipment availability. Standard Forest Service techniques (Reforestation Handbook Chapter 700) would be utilized to plant trees. Mulching may be employed to conserve moisture and reduce competition.

The development of mycorrhizae on roots of forest trees is accepted as necessary for good survival and growth, especially in soils low in available nutrient. SPGMR would obtain stock raised in containers where the soil medium has been inoculated with mycorrhizae, if available.

Competition between herbaceous vegetation and trees would be reduced by one or more of the following method:

- Scalping
- Chemicals (if approved)
- Mulching (including but not limited to straw, wood chips, rock, plastic, or paper)
- Selective broadcasting of the herbaceous seed mixture.

Fertilization and Mulching

Fertilizer application rates would be based on soil tests and designed to achieve soil macronutrient levels capable of promoting plant growth and productivity. Vegetative characteristics such as vigor, color, growth rate, etc., would be monitored to determine soil fertility.

Mulching would be used for erosion control and soil moisture retention, and to supply supplemental organic material. Mulch application rates will depend on seeding method and slope. Only straw mulches free of noxious weed seed would be used. Straw mulch may be applied at a rate of one ton/acre on drill seeded surfaces and up to two tons/acre on steeper slopes. Mulch would be anchored using a crimper, disc, or dozer track. A tackifier may be applied at the manufacturer's recommended rate on areas that are mulched in the fall and on areas which require prompt stabilization.

Revegetation Monitoring

Revegetation would be evaluated by field reconnaissance during the first season following seeding and planting to determine initial revegetation success. Adjustments to the revegetation program may be made based on field evaluations.

need more monitoring!

40-19





rock onto the fabric. The platform would be constructed from the edges of the impoundment toward the low point.

Should final reclamation of the tailing impoundment result in water production, then a spray evaporation system would be installed for disposition of the water. This system along with normal evaporation would dispose of approximately 50 to 75 gallons per minute. If additional dewatering is necessary to meet reclamation schedules or dispose of excess water in a particularly wet year, then the installation of a water treatment facility would be evaluated to ensure the quality of the effluent would meet the limits set in a MPDES permit. (Further discussion of reclamation needs for meeting Montana non-degradation requirements is included in Subsection 4.2)

Grading

After the tailing has been sufficiently dewatered to support construction equipment, the surface would be regraded. Tailing would be bulldozed to prevent runoff over the embankment face and to account for differential settling. It is estimated that during the two years following reclamation, settlements of up to two feet could occur near the center of the impoundment where the tailing depth is greatest; smaller settlements would occur toward the edges of the impoundment. Additional settlements of up to three inches would be anticipated during the next three years. Regrading would result in some compaction; however, final contouring would take into account expected settlement so that depressions would not occur.

Grading would be conducted so that a minimum one percent slope (post-settlement) away from the embankment would be achieved. Surface drainage from the impoundment would be collected by the perimeter drainage ditch and would flow around the ends of the impoundment into natural channels.

In areas of the impoundment where the tailing is difficult to dewater, the tailing could be covered with mine waste rock. The tailing would have a low load-bearing capacity and it may be necessary to provide subgrade reinforcement, typically consisting of a subgrade stabilization fabric which would prevent load-bearing failure caused by the weight of the mine waste rock and construction equipment. The fabric would also act as a filter between the two materials to prevent the tailing from migrating into the mine waste rock. If a stabilization fabric is not used, a synthetic filter fabric or layer of sand/sandy soil may be necessary to act as a tailing trap.

### 2.3.20.8 Soil Handling

Excavation for the tailing impoundment, mill site, percolation pond area, and associated facilities would provide an estimated 478,160 bank cubic yards of soil which would be stockpiled for later use in reclamation. The soil storage piles would have maximum side slopes of 2(H):1(V), and a minimum surface slope of 2 percent to promote surface drainage.

* Soil salvage difficulties due to large rock masses may preclude the salvage of estimated soil volumes. However, stockpile estimates should allow an average distribution depth of approximately two inches on the tailing impoundment surface. Tailing and waste rock would also be evaluated for use as a soil or soil substitute. SMC has conducted leachability tests on waste rock, mill waste, tailing, and other process streams

Is this adequate for reclamation?

40-20



There is no reference of where we can look at the vegetation map? Also need a complete list of all species in areas that will be disturbed (ie tailings pond, road to mine, construction site, Placer Basin) Without a veg. map this info is useless.

40-21



More moist aspects and higher elevations are dominated by subalpine fir, lodgepole pine, whitebark pine and spruce. Spruce habitat types cover about 6 percent of the study area while subalpine fir habitat types accounted for just over 30 percent of the area.

The highest elevations have alpine forb and grass communities intermixed with wind-stunted conifer forests of whitebark pine, subalpine fir, and spruce.

Vegetation was described in 28 mapping units including 5 climax conifer series. These 5 series include limber pine, Douglas-fir, spruce, subalpine fir and scree. Of the 28 different units, 14 of them are named for individual habitat types as described in Forest Habitat Types Of Montana, (Pfister et al. 1977). Six mapping units are complexes of habitat types and eight additional mapping units describe broad plant/land use associations. These broad mapping units are agricultural, shrub-steppe, aspen, bottomland hardwood, cropland, pasture, rangeland, and meadow. Table 3.8-1 lists acreages and extent of all mapping units.

### 3.8.2 Habitat Types and Plant Communities

The study area for the vegetation portion of this document was delineated to include all anticipated phases of project development. Brief descriptions of vegetation mapping units are presented below.

**MAP UNIT 010, SCREE/ROCK:** This unit describes the steep, generally unstable slopes covered with loose rock and coarse fragments and an associated vegetative component. The overstory is composed of Douglas-fir, limber pine, and subalpine fir. This unit composes 4.55 percent of the study area.

**MAP UNIT 011, WATER:** This mapping unit has a total of 72 acres which is 0.44 percent of the study area.

**MAP UNIT 012, RESIDENTIAL:** Homesteads within the study area were mapped in this unit. It is responsible for 0.17 percent of the area.

**MAP UNIT 013, CROPLAND:** This map unit is found in the lower elevation and in the northern vicinity of the study area. Typical crops grown in the area are small grains and alfalfa. Cropland was mapped on 1,104 acres and accounts for 6.71 percent of the total area.

**MAP UNIT 014, PASTURE:** Pasture is a site where the vegetation is used primarily by grazing animals. This unit is found in the northern portion of the study area in the lower elevations and was mapped on 2,089 acres comprising 12.7 percent of the study area. Pasture was the second largest mapped acreage in the area.

**MAP UNIT 015, MEADOW:** Timothy is the dominant species in the acreage within GNF property mapped as meadow. This mapping unit is composed of 525 acres and is 3.19 percent of the total study area.

**MAP UNIT 016, RANGELAND:** The dominant plants in rangeland are grasses. This unit was mapped only on the private ownership portion of the study area. Other rangeland on the GNF portion of the study area is mapped as shrub-steppe and has condition class reference on the Dry Fork allotment. The condition is mostly good and excellent and the trend is generally up. There are 1,420 acres of range which is 8.63 percent of the total area.

* Need better baseline data in EIS & to compare existing native plant species to proposed reclaimed plant seeding.

40-22

Reveg.

1. What is the effect of using non-native species ? (as proposed in p 2·50 - 2·54) 40-23
2. What is effect of using same species for high elev. as for low elev. ) 40-24
3. Why not try experiments on reveg now with same species as proposed for reveg. when mine closes? 40-25



p-54 (Table 2.3-19) Not only 2 grasses proposed in tailings pond reveg plus 3 out of 7 are non-native. 40-26

revegetation of the disturbed areas, where reasonably practicable, and rehabilitation of fisheries and wildlife habitat if necessary." more specific, what defines practicable. 40-27

4.8.2 Alternative 2 - Proposed Action

The alternative is the SPGMR proposal and would remove vegetation from 233 acres. These sites are included in the East Boulder, Brownlee Creek, and Placer Basin permit areas and along road and power line routes. Approximately 50 acres would be disturbed by road construction and road improvements.

East Boulder Permit Area. The East Boulder permit area would include the adit and mine support facilities. This permit area is 260 acres of which 200 acres would be physically disturbed.

Is this correct ? or is this all high elevation what may occur at tailings pond & what at Placer Basin 40-28

The habitat types that would be impacted by vegetation removal are subalpine fir/pinegrass and subalpine fir/grouse whortleberry/pinegrass types. About 50 acres of the overstory have already been removed (Krueger, personal communication, 1990b). The tailing impoundment would cover approximately 105 acres. At project completion, the impoundment would be reclaimed if possible to provide wildlife habitat. SPGMR plans call for removal of all mine-related facilities, but the company is willing to consider leaving certain facilities, especially buildings, if this is considered beneficial. —What are the benefits to leaving them. 40-29 40-30

No site construction activities are planned in riparian and wetland areas, with the exception of road and bridge work. Minor impacts may occur from runoff containing sediments or chemicals if this runoff enters riparian and wetland sites. The permit area extends north to intersect the East Boulder River and, in two small sections it actually crosses the stream. The current bridge which accesses the Dry Fork would be utilized in the future with no further construction activities.

specific disturbance

Seven existing stream crossings would be upgraded with larger structures. This reconstruction would require minor disturbance of riparian and wetland vegetation. Bridge upgrades would likely occur during exploration activities and have been approved as part of the Jackpine Exploration Project. 40-31

40-32 The small, white-flowered form of yellow springbeauty, classified as "sensitive" by the Northern Region of the U.S. Forest Service and as "critically imperiled" by the Montana Natural Heritage Program, would be locally impacted by the facilities on this site. All plants within the tailing impoundment area would be destroyed by construction, and it is assumed that all plants present within the East Boulder permit area would be destroyed as well. Other populations of this springbeauty, identified according to leaf shape and petal color, were identified throughout the East Boulder River and West Boulder River drainages (J. Nixon, personal communication, 1990). These other populations would not be impacted by the mine. There appears to be some unique genetics present in the Boulder population while the overall magnitude of the impact is projected to be small. Further study of the population is needed to determine what percent will be affected. This study will be conducted in June 1991 (between the draft and the final EIS). The study will determine the range of population in the area. Will this study be included in draft EIS ? 40-33

All disturbed sites have potential for weed invasion. The most likely weed candidates are those common to the area, including leafy spurge and Canada thistle. Spotted knapweed may also invade these sites due to its widespread distribution across the state and its ease of transport by vehicles. Other potential weed problems include hound's tongue, musk thistle, burdock, and others. This alternative addresses the Montana

What about weed control during reclamation ? Who is responsible ? 40-34



Only pre-mine [illegible] on [illegible] p 59 (2.3.20.8) It clearly states that there is a real possibility that only 2 inches of topsoil will be salvaged for the tailing impoundment surface. What reclamation is possible with only 2 inches, especially for trees & shrubs ? 40-41



Road and facilities construction would create an opportunity for weed establishment by exposing bare soil. Significant weed infestations are unlikely in this permit area due to the cold climate. 40-42

Is this information for Placer Basin ? Need to have another heading.

The reclamation efforts proposed in this alternative focus on post-milling landscape planning. The stated goal of reclamation is to revegetate to native species and provide wildlife habitat, principally for mule deer. Some areas would be reclaimed and revegetated during the life of the project. These include soil stockpiles, percolation pond embankments, drainage and diversion ditches, cut and fill slopes, and borrow pits. Areas revegetated and reclaimed during mine operation would be evaluated on an on-going basis. The knowledge gained during this reclamation and evaluation process would be utilized for the final closure reclamation.

The road system proposed under this alternative includes 2.6 miles of new road construction and upgrades for 25 miles of existing road. The upgraded sections of road utilized by the public after closure would not be reclaimed. Roads determined by the U.S. Forest Service to be non-beneficial to the public or not in compliance with forest management objectives would be recontoured and seeded to the appropriate species mix. Noxious weed control is the responsibility of the company and would take place on a regular basis, although specific methods for this activity have not been identified. Impact of spraying weeds on surrounding vegetation. 40-43

Species selection is NOT applicable if the goal is to revegetate to existing native species.

The success or failure of reclamation is dependent on the amount and quality of soil available, the applicability of species selected for revegetation, seedbed preparation, and post reclamation disturbance such as erosion, fire, or grazing. SPGMR has identified appropriate species for revegetation and methods for reclamation of disturbed areas. Approximately 9,000 yd³ of reclaimable soils have been identified in this area which should provide a suitable stockpile. what are * This does NOT compare to amt claimed in Soils 3.4.2 40-44

4.8.3 Alternative 3 - Modified Tailing Impoundment Configuration

This alternative configuration is almost identical to the proposed except the slope of the tailing impoundment would be less steep (2(H):1(V) instead of 1.6(H):1(V)). The modified tailing dam face can be reclaimed through a terraced vegetative scheme. Compare the success of reveg of these 2 slope ratios 40-45

40-46 4.8.4 Alternative 4 - Alternative Access Road/Power Line Alignments

This alternative is almost identical to Alternative 2 except for changes in access roads. The difference between the Bench Route (R2) and the Bench/Valley Route (R4) is a one-mile long section of road in sections 33 and 4 (Figure 2.4-2).

Both road locations would result in approximately 6 miles of new road construction or upgrade. This option would include disturbance of cropland, rangeland, pasture, and meadow along part of route.

Both roads would also intersect a series of wetlands, identified in Subsection 3.8. New road construction would have 2 or 3 new stream crossings. Two of the three crossings are on intermittent drainages and may not require a bridge. The Bench Route has one less stream crossing than the Bench/Valley Route.

* Drainage for road construction may reduce wetland area size depending on specific construction plans which are as yet undeveloped. Loss of wetlands, if approved for road construction, would likely require replacement to ensure no net loss in accordance with Presidential policy.

more specific, without construction plans impossible to determine impacts. 40-47

Is replacement of wetlands possible ? 40-48





County Noxious Weed Control Act through a SPGMR commitment to pursue an active weed control program in conjunction with Sweet Grass County.

This alternative would remove approximately 200 acres from timber production on a permanent basis. GNF is proposing to reclassify the area from Management Area 8 (timber emphasis) to Management Area 24 (mining emphasis). The Draft Stillwater Complex Integrated Resource Analysis suggests an additional 100 acres of timber would be harvested from compartments 112 and 115 if the SPGMR permit is approved.

What specific tree species to be harvested 40-35

Brownlee Creek Permit Area. At the Brownlee Creek permit area, 3 of the 4 permit acres would be disturbed. The principle habitat type at this site is subalpine fir/grouse whortle/grouse whortleberry, although a major portion of this area is mapped as scree. No roads would be constructed to this site.

This permit area boundary abuts both Brownlee Creek and the East Boulder River. Creek-side riparian and wetland vegetation may be locally impacted depending on the amount of surface disturbance, the proximity of disturbance to the wetland/riparian area, and the type of drainage controls installed. Impact to riparian/wetland vegetation could result from runoff carrying sediments or chemicals into the surface drainages which could inhibit photosynthesis or other biological processes and reduce plant viability. However, easily eroded sediments are not readily available in this area so stream siltation should not occur. SPGMR's commitment to use best management practices would also help to alleviate concerns over runoff problems. Finally, no chemicals have been identified for use in this area which would present a problem to vegetation.

No commercial timber exists at this location.

Weed infestation is dependent on a seed source and suitable seedbed and site conditions. The potential for invasion of weeds on this site is low since no road system would be utilized for transportation. This reduces the availability of weed seeds, although a low possibility exists that weeds could still be transported by miners, helicopters, or some other method.

With sufficient soil availability, scree sites could be easily reclaimed to scree with nutrients and the appropriate vegetative mix. Since no soil is available for stockpiling in this permit area, reclamation success is expected to be much more difficult. Alternative methods for reclamation would need to be determined, or plans developed for soil importation to use in reclamation procedures. 40-36

Placer Basin Permit Area. The Placer Basin permit area is the largest of the three permit areas. It includes 580 acres, of which 30 have been previously disturbed. Most disturbance would occur near the Frog Pond adit. Current vegetation at the Frog Pond adit is dominated by the subalpine fir-whitebark pine/grouse whortleberry habitat type. Same as tailings pond except pinegrass ? How many acres will have vegetation removed ? species list ? 40-37 40-38

The riparian/wetland inventory did not include this permit area, but small patches of riparian/wetland are expected to occur in swales and depressions. Negative impacts to this area would occur if roads or other facilities are constructed on or very near riparian/wetland sites such that erosion and sedimentation fills in riparian/wetland locations or is of sufficient quantity to reduce oxygen availability and photosynthetic functions. Use of BMPs should help to minimize this potential.

No commercial timber occurs in this permit area.

No mention of using locally collected seed source as was in 2.3.20.1 40-39

No soil can be stockpiled here because there is none (3.4.2.3) What are the impacts of imported soil here ? How will this be reclaimed ? No roads ? 40-40





Disturbed areas may be colonized by weeds. Disturbances along roads and powerlines would be especially prone to weed invasion due to available seed source and favorable climate. It is likely that some weed infestation would occur as a result of new road development, although weed control procedures would reduce the spread and possibly eliminate specific colonies. This impact can be especially detrimental to nearby agricultural and range lands.

4.8.5 Alternative 5 - Alternative Power Supply Systems

Construction of a new power line to the East Boulder permit area would disturb vegetation along the route and where temporary roads are utilized for tower construction. There will be approximately 25-mile corridor for the new powerline.

The rangeland communities and productive agricultural lands disturbed by construction of either system would be removed only temporarily from productive use except where cultural practices such as irrigation are attached. Immediate revegetation could improve the production on some range sites.

The disturbance associated with the construction of a new powerline could create an opening for weeds to become established. Disturbances along roads and powerlines would be especially prone to weed invasion due to available seed source and favorable climate. As noted in Alternative 4, implementation of weed control procedures would help to reduce the spread of noxious weeds. However, impacts of weed infestation can be serious in this area because the current land use is agricultural and/or grazing.

4.8.6 Alternative 6 - Water Treatment Alternatives

No additional impacts beyond those impacts described in Subsection 4.8.2 would result from implementation of one of the water treatment alternatives.

4.8.7 Alternative 7 - Proposed Action with Modifications

Impacts on vegetation, wetlands, and timber resources from the implementation of this alternative would be the same as those described for Alternative 2 - Proposed Action (Subsection 4.8.2) with the exception of those impacts mitigated by measures identified in Subsection 2.5. Additional mitigation measures required by the DSL and GNF in this alternative would effectively reduce or eliminate residual impacts to these resources remaining after the application of SPGMR's mitigation program. The impacts to be mitigated under this alternative are identified below by project component.

Grass species list in reclamation is not diverse especially when it comes to forbs

Tailing Impoundment Reclamation. Vegetation to be established on the tailing impoundment must be selected based on achieving acceptable biological diversity and ability to provide visual screening in addition to stabilizing the soil surface. The establishment of a diverse stand of vegetation on the reclaimed tailing impoundment would enhance the long-term maintenance of a protective vegetative cover on this sensitive facility. These mitigations would help ensure that post-reclamation land management objectives are met as well as reduce the visual impact of the tailing impoundment on the surrounding environment (See Subsection 4.12-7).

Wildlife. The establishment of unpalatable plant species in disturbed areas adjacent to roads would likely reduce the potential for wildlife roadkills. The required distribution survey for the sensitive plant species

the list is completely inadequate 40-49

Clavtonia lanceolata var. flava in 1991 would help in determining the need for and the measures necessary to protect populations in the project area. Need to include Study in chp 3. **40-50**

Visuals. The development and implementation of a vegetation management program to promote visual screening of the tailing impoundment and other mine facilities which do not meet the visual quality standards on GNF lands would likely reduce visual impacts to acceptable levels.

Wetlands. The avoidance of construction including dredging or backfilling in wetland/riparian communities would help ensure compliance with Presidential Executive Order 11990 requiring "no net loss of wetlands." Avoidance is considered by the agencies to be possible for all aspects of this project, with the exception of the installation of new bridges or upgrade of existing structures. Best management practices must be followed to minimize impacts associated with these activities. What are these practices
More on impacts to wetlands. **40-51**

East Boulder Plateau. Breakouts on the East Boulder Plateau, scheduled to occur throughout the life of the mine, would be approved by DSL and GNF prior to construction. A vegetation survey including wetlands analysis would be conducted prior to approval of breakouts. Breakouts would be designed to avoid adverse impact to wetlands or Clavtonia lanceolata var. flava.

4.8.8 Cumulative Impacts

Cumulative impacts resulting from this project in addition to other GNF projects should not have substantial additional impacts on vegetation. No plant species of special concern would be eliminated. No cumulative effects would lead to substantial changes in widespread vegetation patterns for any plant community including wetland/riparian types. The spread of noxious weeds and weed control efforts would not be altered substantially by the cumulative effects of this project. Cumulative effects associated with additional timber removal were discussed in Subsection 4.8.2, and would be addressed in the Forest Service area management plans. What other GNF project would remove over 100 acres of vegetation completely?
What if reclamation fails? **40-52**

## 4.9 AIR QUALITY

4.9.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. During the exploration program, particulate and gaseous emissions will result from the following exploration activities and electrical power generation:

- Ore stockpiling
- Soil stockpiling
- Exposed disturbed areas
- Waste rock dumping
- Vehicle operations on unpaved roads
- Diesel exhaust from vehicles or generators
- Electrical power generation





**40-54** Where is soil survey? This info should be in EIS. or else where it can be fou

3.4.2 Soil Conditions at Proposed Sites of Disturbance

The East Boulder Mine Project includes approximately 844 acres, of which about 233 acres may be dist at three separate sites (see Figure 2.3-3). The amount of soil available for salvage was originally esti as approximately 68,000 cubic yards. The Order 1 soil survey of the East Boulder Permit Area suggest considerably more is available although some lower soil horizons are included in this estimate. Salvag stockpiling many of these soils will be difficult due to high rock content including boulders in some Approximately 487,000 bank cubic yards are estimated to be available for reclamation. A more de discussion of soil features is presented for each of these three disturbance sites.
Large amt of change from 68,000 - 487,000! **40-55**

* Chapter 4-58 says approx 9500 yds have been ident. for reclamation

Is the soil available for salvage in the tailings pond area only?

**40-56**

3.4.2.1 East Boulder Permit Area

Soils at the East Boulder permit area (main mine area) are mostly formed in glacial till parent ma containing mixed rock types. This glacial till has loam and clay loam textures with 20 to 50 percent fragments from gravel to boulder size. Soils usually have a gravelly loam surface layer and very gr loam to clayloam subsoils. Small areas of soils occur along the immediate stream channel formed in s deposits (alluvium). These soils are highly variable and may have sandy to clayey textures. Alluvial within and near the floodplain have shallow water tables for portions of the year. Most soils at the Boulder permit area are classified as Cryoboralfs and Cryoborolls.

Topography of this location is a rolling glacial till landscape bordered by steep mountain slopes. Soil usually thinner and less developed on steeper slopes and drier exposures. Nearly level stream ter parallel portions of the stream.

Vegetation is mostly dry conifer forest which adds an organic "litter" layer to the soil surface consisti partially decomposed needles, twigs, and other plant parts. Small areas dominated by grasses, aspe certain moist-site species have surface soils that are high in organic matter and very dark in color.

Soils at this location are among the better soils in the general area since they are deep and have silt and contents ranging from 20 to 50 percent for the silt fraction and 5 to 15 percent for the clay fraction. T have much higher moisture and nutrient holding capacities than many other local soils. These feat reduce erosion potential and provide easier revegetation and reclamation. These soils have moderate ero potentials when the surface organic layer is removed. They do not have adverse chemical properties s as low pH, high salts, excess carbonates, or heavy metals.

3.4.2.2 Brownlee Creek Permit Area

Soils at the Brownlee Creek permit area are mostly formed in glacial till parent material dominated by h coarse-grained igneous rocks or metamorphosed crystalline rocks. This glacial till has sandy loam text with 30 to 60 percent rock fragments from gravel to boulder size. Soils usually have a gravelly sandy lo surface layer and very gravelly sandy loam subsoil. Small areas of soils occur along the immediate str channel formed in stream deposits. These soils often have more sand and rock than glacial till soils. Str deposit soils may also have shallow water tables for portions of the year. Most soils at the Brownlee Cr permit area are classified as loamy-skeletal, mixed, Typic Cryochrepts.



SOILS



percentages of major ions, with the exception of the lower alluvial aquifer being lower in sulfate, sodium, and potassium. Calcium, magnesium, and bicarbonate concentrations increase, and sulfate decreases in a downvalley direction. The glacial aquifers have similar water quality, except for sulfate being higher in the lower glacial aquifer. Bedrock water quality is generally similar to glacial aquifer water quality, where they are separated by the lower alluvial aquifer. In these areas, the lower alluvial aquifer has similar water quality to the Dry Fork. A summary of groundwater quality for selected wells in the area is contained in Table 3.3-3.

Montana groundwater regulations (ARM 16.20.1001 et seq) classify groundwater into four classes based on existing quality and use. Groundwater which is used for drinking water purposes shall not exceed drinking water maximum contaminant levels (MCL). Any increase in the concentration of a parameter for which there exists a drinking water MCL, or which precludes the use of the water as a drinking water source, constitutes degradation and is prohibited except as provided in ARM 16.20.701 et seq.

## 3.4 SOILS

Soil information has been collected by both the US Forest Service and by consultants to SPGMR. An Order 3 soil survey of the GNF was completed in 1984. This survey provides general soil information about the entire project area. The study area for soil resources is limited to the three project permit areas (Figure 2.3-3). An Order 1 soil survey of the East Boulder Mine Project site was completed in 1990 by a private consulting firm. This survey provides more detailed soil information for the East Boulder Mine Project site.

3.4.1 General Soil Conditions

Soil conditions across the study area are highly variable due to differences in the soil-forming factors of parent material, topography, vegetation, climate, and time. Parent materials within the project area include a wide variety of rock types and deposits. Figure 3.4-1 illustrates very general relations of soil and parent materials to elevation in the project area. Limestone, sandstone, shale, gneiss, and granite are the most common rock types. Colluvium, alluvium, and glacial till are the most common erosional deposits. Topography ranges from nearly level stream terraces and ridges to nearly vertical cirque headwalls, canyon walls, and stream terrace edges. Vegetation ranges from streambank riparian shrub communities to wind-deformed subalpine conifer forest and alpine meadow. The climate is generally dry and cold (annual precipitation 20-25 inches, annual temperature 38°F). Soils are young, having formed in deposits of recent geologic age, and often display little alteration from their original condition.

In general, soils are deepest and most developed in valley-bottom positions and on lower mountain slopes where glaciers, streams, and gravity have deposited fine parent material. They are usually deep with loam, sandy loam and clay loam textures. Rock contents are commonly 20 to 50 percent. Soils on sites with abundant grasses and forbs may have a dark surface layer. Soils are shallowest and least productive on the upper slopes, steep areas, and near rock outcrops. These soils usually have sandy loam textures and 50 to 70 percent rock fragments. Overall, there is some good quality soil available for reclamation purposes in some areas. - What areas? **40-53**





Topography at the Brownlee Creek permit area is a moderately sloping landscape of mixed glacial and slope-wash deposits bordered by steep mountain slopes. Soils are usually thinner and less developed on the steeper slopes. Nearly level stream terraces parallel portions of the stream.

Vegetation is sparse, but when present consists mostly of cold, dry conifer forest which adds an organic "litter" layer to the soil surface consisting of partially decomposed needles, twigs, and other plant parts.

These soils have relatively low moisture and nutrient holding capacities. They have moderate to high erosion potentials when the surface organic layer is removed. Revegetation, reclamation, and erosion control should be relatively easy with these soils in this climate. These soils do not have adverse chemical properties such as low pH, high salts, excess carbonates, or heavy metals.

3.4.2.3 Placer Basin Permit Area

Soils at locations to be disturbed throughout the Placer Basin permit area are mostly formed in granite and gneiss. The source of most soil materials is weathered bedrock with minor additions of materials left by glaciation or carried to the site by wind. These soils often have very gravelly silt loam, or sandy loam surface soils and extremely gravelly sandy loam subsoils. Shallow soils dominate this area and all are very rocky. Hard bedrock often occurs at shallow depths (<20 inches).

Topography at most of the disturbance locations is gently rolling ridgetop and plateau. The 8650 adit site is on steeper slopes.

Vegetation is mostly cold, wind-formed conifer forest near the limits of tree growth, although pockets of well developed lodgepole pine, Douglas-fir, and subalpine fir can be found. These trees add an organic "litter" layer to the soil surface consisting of partially decomposed needles, twigs, and other plant parts. Some sites have alpine meadow vegetation dominated by grasses, sedges, and forbs. Soils at these non-forest sites often have a surface layer high in organic matter and are very dark in color.

These soils have very low moisture and nutrient holding capacities. They have moderate erosion potentials when the surface organic layer is removed.

Reclamation is difficult with most of these soils due to shallow depth, high rock content, and cold climate. High rock content in the surface reduces space for plants to root and reduces their access to water and nutrients. The shallow depth to bedrock can create extremes of moisture which impede plant growth. Soils may be saturated in spring and early summer from snowmelt waters "perched" on bedrock. Soils may then dry out rapidly to extremely low total moisture contents, presenting plants with drought stress that were, just a few weeks before, saturated with water.

Despite physical soil problems, these soils do not have adverse chemical properties such as low pH, high salts, excess carbonates, or heavy metals.

Separating and saving potential soil materials is difficult on these sites due to thin soil, rock content, and shallowness. Soil suited to reclamation is usually only a few inches thick or less. It may be more effective to import soil than to attempt to use native materials. Some sites may be more rationally reclaimed to rock or talus if these fit the prior condition of final landscape setting. **40-57**
What are the impacts if this area is not reclaimed well?
P 2-56 2.3.20.2 says that 9050 yds are available from E. Boulder Plateau.
where will it come from? **40-58**

SOILS



#### 4.3.8 Cumulative Impacts

There are no known projects which would contribute additional environmental impacts on the area groundwater. Evaluation of the cumulative impacts from implementation of the East Boulder Mine Project to groundwater resources are based on the following criteria: knowledge of current issues and concerns; past experience with similar projects; and projects which could impact the proposed project. This evaluation did not indicate the presence of any major cumulative impacts to groundwater resources in addition to those discussed previously as related to the proposed project implementation. However, all projects considered now or in the future must meed MPDES standards and comply with non-degradation policies of the state of Montana until or unless a variance from compliance is issued by the Montana Board of Health. **40-59**

### 4.4 SOILS

27 years of distruption!

Environmental consequences on soils should be minor and short-term under most alternatives, provided appropriate construction and reclamation methods are employed. Soil impacts are directly related to the amount of area disturbed. The greatest impacts result from removal and stockpiling soil from settling pond and facilities areas. This complete soil disturbance may cause a small long-term decrease in soil productivity. Temporary impacts would result from soil disturbance near portals, adits, roadways, stream-crossings, and power-corridors. Only minor and temporary impacts on water quality should occur as a result of soil erosion and sedimentation or reconstruction of stream-crossings.

This is not clearly stated **40-60**

1.4.2 says these will create Major Impacts **40-61**

#### 4.4.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities will continue under the approved Jackpine Exploration Permit. Major sources of soil impacts include construction of the exploration adit, percolation ponds, access road, and support facilities. Approximately 30 acres will be disturbed during the two-year exploration project.

A small amount of soil from ponds and facility areas will be removed and stockpiled for reclamation. Stockpiling will be for a two-year project period. Stockpiled soil will be subject to wind and water erosion for relatively short periods during manipulation and revegetation. On most sites only slight decreases in long-term soil productivity will occur. This effect results in slightly less productive vegetative growth. This action should not preclude revegetation to pre-mine native species.

Activities that remove vegetation and the surface organic litter layer expose soil to erosion by wind and water. Buildings and related facilities occupy small areas of a few acres. Approximately 1.0 mile of new road has been constructed.

Seven existing stream crossings will be rebuilt to handle heavier loads. This rebuilding requires direct manipulation of streambank soils and creates short-term minor sedimentation impacts. Soil near crossings will be exposed to erosion and stream sedimentation until vegetation is reestablished and erosion control features are installed. Long-term impacts of stream crossing will be dependent on road use and maintenance. → more specific impacts, what are these? **40-62**

* What are the impacts of soil erosion in first years of reclamation. What if reclamation fails these first yrs due to washing of seed, dry conditions, etc. **40-63**



What are impacts to soil when stockpiled for 25 yrs? **40-64**



#### 4.4.2 Alternative 2 - Proposed Action

Very little is discussed about soil compaction and effect on reclamation success. **40-65**

Major impacts to soils include construction of portals, ponds, roads, powerlines, and support facilities. Approximately 203 additional acres would be disturbed in this alternative, for a total of 233 disturbed acres when considered in addition to Alternative 1's existing soil disturbance.

How much area would be needed to stockpile soil? **40-66**

Soil from other disturbed areas would be removed and stockpiled for reclamation across approximately 200 acres. Original estimates suggested that only two inches of soil was available for a total of 68,000 cubic yards at the East Boulder permit area and 10 cubic yards at the Placer Basin permit area. No suitable soil was available for stockpiling at Brownlee Creek. Stockpiles would have 2(H):1(V) sideslopes. Stockpile surfaces would have at least two-percent slopes. Would topsoil become mixed with subsoil? **40-68**

3.4.2. says that salvage + stockpiling will be difficult due to high rock content. **40-67**

A recent, more detailed soil inventory revealed that the East Boulder permit area has from 0 to 60 inches of soil suitable for stockpiling and reclamation. Based on projected soil replacement volumes committed to by SPGMR in the application, approximately 21 inches of soil would be redistributed on 158 acres at the tailing impoundment and mill and mine support complex. SPGMR has committed to replace 6 inches on the 33 acres of mine workings at the Brownlee Creek and Placer Basin permit areas. Stockpiling would be for approximately a 25-year period. Stockpiled soil would be subject to wind and water erosion during the short periods of manipulation and revegetation. A slight decrease in long-term soil productivity would occur causing slightly less productive vegetative growth during initial reclamation. Soil removal and storage should not preclude revegetation to pre-mine native plant species. → what would cause this productivity decreas **40-69**

Where would this come from, how will it get there **40-70**

Seven existing stream crossings would be rebuilt to handle heavier loads. This rebuilding would require direct manipulation of streambank soils and create short-term minor sedimentation impacts. Soil near crossings would be exposed to erosion and stream sedimentation until vegetation is reestablished and erosion control features are installed. Long-term impacts of stream crossings would be dependent on road use and maintenance. Sediment loads resulting from such erosion are discussed under Subsection 4.2, Surface Water Resources. → explain? **40-74**

W Sfr imp **40-73**

No vegetation species list has been suggested for wetland

What about the rocks + boulders in the soil would they be removed initially? **40-71**

Approximately 2.6 miles of new road would be constructed, and 26 miles of existing road would be reconstructed. Approximately 2.6 miles of new powerline would be constructed, and 12 to 15 miles of existing powerline upgrade would occur. Road and powerline construction would create the opportunity for soil erosion until vegetation is reestablished and erosion control features are installed. **40-75**

#### 4.4.3 Alternative 3 - Modified Tailings Impoundment Configuration

The modified configuration is almost identical to the Alternative 2 configuration, except that the slope of the tailing pond embankment sections would be less steep (2(H):1(V) instead of 1.6(H):1(V)). Reclamation may be enhanced on the less steep slope. Since the impoundment's outside perimeter is not different from that proposed by SPGMR, impacts would be similar. However, the less steep embankment slope would require more material for construction. would there still be enough topsoil? **40-76**

#### 4.4.4 Alternative 4 - Alternative Access Roads and Power Line Alignments

Bench Route (R2). This route would increase the length of new road from 2.6 to 6.5 miles exposing additional soil to erosion. The number of stream crossings requiring construction or reconstruction would

Looking at chap 2-59 last paragraph says that soil salvage difficulties would preclude salvage of est. volume but should allow for 2" on tailing impoundment - this is a direct contridiction **40-72**





Soils. To ensure the availability of suitable soil materials for use in reclamation, the agencies would require that all available, suitable soil be salvaged and stockpiled ahead of facilities construction. This mandate to ensure adequate volumes of suitable soil be salvaged would enhance the probability for successful reclamation/revegetation of disturbed lands. The agencies' requirement to reduce slopes of soil stockpiles to 2(H):1(V) would reduce soil erosion and promote surface stability and the establishment of protective vegetation.

East Boulder Plateau. Breakouts on the East Boulder Plateau, scheduled to occur throughout the life of the mine, would be approved by DSL and GNF prior to their construction. A soil survey would be conducted prior to approval of the breakouts.

#### 4.4.8 Cumulative Impacts

What if reclamation is unsuccessful **40-77**

Cumulative impacts on soil resources resulting from this project in conjunction with other GNF projects would not be high. No excessive soil erosion would occur which, in conjunction with other project erosion, would dramatically impact resources. This analysis assumes that proper construction and mitigation practices would be employed to prevent excessive soil erosion and sedimentation. The cumulative impacts of all local projects would not eliminate any unique soil resources.

### 4.5 GEOLOGY AND GEOTECHNICAL CONDITIONS

#### 4.5.1 Alternative 1 - No Action

Under this alternative, existing mine exploration and development activities would continue under the approved Jackpine Exploration Permit. This includes construction of one mile of access road, the approved exploration adit and surface facilities, i.e., the waste rock storage, soil storage piles, and percolation ponds. Impacts on geologic and geotechnical conditions will be minimal during the exploration program. The excavation of the adit will include the deposition of waste rock on less than 10 acres outside the adit portal. There will be no mining related disturbances on the plateau.

#### 4.5.2 Alternative 2 - Proposed Action

##### 4.5.2.1 Topography and Geomorphology

The area that would be disturbed by the proposed mining, milling, and tailing disposal facilities would change from a hummocky shape to a more graded appearance, resulting in less infiltration and increased runoff. The major topographic change would be the tailing pond, which would become a plateau-like area with steep downstream slopes (1.6(H):1(V)) up to 140 feet high.

The shop, mill site, and surplus waste rock disposal areas would remain relatively flat areas that would easily revegetate, and eventually blend into the landscape.

By design, very little new disturbance would occur in the Placer Basin Permit Area. Existing disturbance is related to previous exploration. The proposed ventilation raises and escapeways would be sealed with a concrete plug, leaving only small level pads. Since access to Brownlee Creek would be only by helicopter, it would not be practical to bring in heavy equipment for site regrading.



Oct. 4, 1991

Comments on Draft EIS for East Boulder Mine

(1) The Montana Water Quality Act forbids any degradation of pristine waters in the state. Exemptions to this non-degradation policy may be granted based on "... necessary economic and social development..." However, the economic value of pristine quality water in the East Boulder River should offset any claim by SPGMR that they need an exemption to the non-degradation policy. To lose the pristine quality of the East Boulder River would have disasterous consequences to:

A. the recreation industry which is flourishing and long term in the Boulder Valley **41-1**

B. the land prices which benefit current land owners in the valley. **41-2**

The degradation of water should not be allowed.

I urge you to choose Alternative 6(a) in the Draft EIS. Mine effluents must be fully treated. A complete description of the treatment facilities and the impacts from the facilities should be included in the EIS. 41-3

(2) The mining company should be required to submit a detailed plan for bussing employees to and from the mine before a permit is granted. I would recommend that 90% of all the employees in each shift be required to be transported by busses both to and from the mine site, with change in employee/bus ratios adjusted once a month. The mining company should not be allowed to build a 200 car parking lot. The impact ~~the~~ upon the size of the mining site and upon the traffic on the Boulder road must be reduced by bussing. 41-4

Thank you Jerry Iverson
Box 1397
Big Timber

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4804 West Sunnyslope Road
Edina, Minnesota 55424
October 12, 1991



Ms. Jo Stephen
Montana Department of State Lands
Capitol Station
Helena, Montana 59620

Dear Ms. Stephen:

I am writing with regard to the request by Stillwater PGM Resources that it be exempted from the requirements of section 75-5-303 of the Montana Code with respect to its proposed East Boulder mine; in part, that provision prohibits degradation of any state waters whose existing quality is higher than the established water quality standards. I oppose the request for the exemption. 42-1

Let me state first that I oppose any mine on the East Boulder. The entire Boulder watershed is a natural treasure that is far more valuable to the people and State of Montana than any short-term economic benefit that may be derived from the development of a platinum-palladium mine. People from all over the United States travel to the Boulder valley to fish and engage in other outdoor recreation. The dollars that those people spend contribute tremendously to the economy of Montana. A mine on the East Boulder, and all the destructive peripheral development that would undoubtedly result from it up and down the valley from the Beartooths to Big Timber, would seriously endanger the great economic resource that the Boulder valley constitutes. If left alone, the Boulder River valley will be of great economic benefit to Montana indefinitely into the future. If mined, it will be ruined. 42-2

At minimum, if the mine is to be built, the company should be required to comply with Alternative 6(a) in the Draft Environmental Impact Statement. That alternative requires a treatment facility that would prevent degradation of the water quality in the East Boulder. Degradation must not be allowed. A finding that an exemption should be granted here on the grounds that it is "justifiable as a result of necessary economic or social development" under section 75-5-303 would be ridiculous. 42-3

Finally, if the mine were to be built it would be absolutely essential that the workers not be allowed to drive private vehicles to the mine. Any permit allowing the mining to proceed must require that the miners be bused to the mine from a parking area located somewhere along Interstate 90. This issue must be settled before any mine is allowed to proceed. Further, there must be in place a fully-funded and bonded reclamation plan for the tailings pond before any mining is allowed to proceed. 42-4

Sincerely,

Reid Carron

Reid Carron

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10/12/91
Mark Thurber
1126 15th Ave E
Seattle, WA 98112

Sally Orr
Resource Asst.
PO Box 196
Big Timber, MT 59011

Dear Ms. Orr,

I would like to comment on the DEIS for the proposed East Boulder mine project. I am concerned about the long-term environmental impacts the project will have on the area surrounding the proposed adit and on the Beartooth Plateau. I have several general questions and recommendations:

(1)Why not extend the existing adit from the Stillwater river to access the ore instead of creating a new facility at East Boulder river. This action perhaps would be more expensive but would reduce the total impact of mining to an area which has already been affected by mining activity. Why has this option not been addressed? 43-1

(2) Development of facilities and adits on the Beartooth Plateau would be an unnecessary intrusion into an area which is intimately linked to the Absaroka-Beartooth wilderness area to the north. If the mining operations are approved at East Boulder river - the Frog Pond adit should be the only plateau access in order to keep modifications to the plateau at a minimum. 43-2

(3) An effort should be made to restrict vehicle access to the area of the mine. The mine should not be used as an excuse for further development of lands surrounding the mine at a later date whether it be another adit, roads, logging, or recreational activities that would degrade the environment surrounding the mine. 43-3

(4) What will be the hydrologic effects to the surface water (e.g. draining of Camp Lake) of mining operations. Has this potential problem been studied in detail? 43-4

(5) I favor option 6A for water treatment standards. 43-5

(6) Has any thought been given to constructing the tailings pile in a manner that blends in with the surrounding topography to minimize the visual impact. 43-6

In addition there are several mistakes in the glossary which should be corrected for the FEIS. These mistakes disturb me. Since I have not had time to comb through the DEIS in detail, I hope there are not more substantive mistakes or misprints in the scientific analysis that have been missed.

Metamorphose - To adjust the mineralogy, chemistry, and/or structure of solid rocks because of physical and chemical conditions imposed at depth. 43-7

Mineralization - The process by which a valuable mineral or minerals are introduced into a rock, resulting in a potential or actual ore deposit.

Joint - A surface of fracture or parting in a rock, without displacement.

These definitions were taken from the AGI Dictionary of Geological Terms. Other definitions in glossary should be checked for accuracy.

Sincerely,

Mark Thurber

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OCT 13, 1991

RECEIVED
OCT 18 1991
STATE LANDS

JO STEPHEN
MT. DEPT. OF STATE LANDS
CAPITOL STATION
HELENA, MT. 59620

DEAR JO,

PLEASE EXCUSE MY HAND WRITTEN COMMENTS; MY TYPEWRITER HAS CHOSEN TODAY TO STAGE A JOB ACTION AND REFUSES TO FUNCTION PROPERLY.

THESE ARE SOME BRIEF COMMENTS REGARDING THE DRAF EIS FOR THE SPGMR EAST BOULDER MINE PROJECT.

RE: WATER DEGREDATION

FOR THE PURPOSES OF THE FINAL EIS, SPECULATING ON ANY FUTURE DECISION BY ANOTHER STATE AGENCY SHOULD NO BE CONSIDERED AN ALTERNATIVE, THE FINAL EIS SHOULD PROVIDE IN MORE DETAIL THE OPERATION, SITING, AND ENVIRONMENTAL CONSEQUENCES DURING MINE OPERATION AND AFTER CLOSURE OF SPECIFIED ALTERNATIVES IN THE DRAFT EIS. 44-1

RE: SEPTIC SYSTEM

ON PAGE 2-74 OF THE DRAFT EIS THERE IS A SHORT SUMMATION PARAGRAPH THAT DEALS WITH ACTIONS "SHOULD PROBLEMS ARISE FROM THE SEPTIC SYSTEM." IS IT POSSIBLE FOR "AN INTERCEPTOR WELL" TO REALISTICLY CAPTURE A "PLUME" OF CONTAMINATED GROUND WATER? THIS MIGHT ATTENTUATE A HORIZONTAL MOVEMENT BUT WHAT ABOUT THE VERTICAL MIGRATION OF CONTAMINATED WATER? "THE CAPTURED FLOW COULD THEN BE ROUTED THROUGH THE APPROPRIATE TREATMENT STREAM." WHAT IS THIS STREAM? IS IT ON-SITE OR OFF-SITE? WHAT ARE THE MONITORING MEASURES TO DETERMINE THE NEED FOR ONE OR MORE INTERCEPTOR WELLS? WHAT MEASURES WILL BE TAKEN IF INTERCEPTOR WELLS ARE NOT EFFECTIVE? 44-2

RE: ROAD MITIGATIONS

BECAUSE ROADS AND TRANSPORTATION HAVE BEEN IDENTIFIED AS AREAS OF SIGNIFICANT CONCERN I WOULD CONSIDER A FINAL EIS INCOMPLETE IF IT DID NOT INCLUDE A DETAILED PLAN FOR REDUCTION OF VEHICULAR TRAFFIC THROUGH BUSSING AND OTHER MEANS, POSSIBLE LOCATION AND SIZE OF STAGING AREA(S), A CONSIDERATION FOR SEASONAL VARIATIONS IN PRESENT TRAFFIC PATTERNS AS WELL AS PROJECTED MINE USAGE AND ANY OTHER MEASURES THAT WOULD MITIGATE IMPACTS ON EXISTING ROAD USES. 44-3

RE: FAS 298

ON PAGE 3-69 OF THE DRAFT EIS A TABLE CHARACTERIZES THE 24 MILE SECTION OF FAS 298 BETWEEN BIG TIMBER AND THE GNF BOUNDRY AS BEING IN "POOR" CONDITION AND ON PAGE 3-70 CONCLUDES THAT "THIS HIGHWAY WAS BUILT IN THE 1930'S AND NOT CONSTRUCTED TO HANDLE LARGE VOLUMES OF HEAVY TRUCK TRAFFIC." 44-4

THE FINAL EIS SHOULD EXPLORE THIS ISSUE. WHAT ARE THE CONSEQUENCES OF "LARGE VOLUMES OF HEAVY TRUCK TRAFFIC" TO THIS ROAD AND TO THE RESIDENTS ALONG FAS 298 AS WELL AS THE COUNTY TAX PAYERS. 44-4

RE: TAILING IMPOUNDMENT RECLAMATION - SECTION 2.5.5

ON PAGE 2-82 OF THE DRAFT EIS A SENTENCE READS "A SPECIFIC PLAN ADDRESSING THIS ISSUE AND RECLAMATION FOR THE IMPOUNDMENT MUST BE SUBMITTED BY SPGMR FOR AGENCY APPROVAL PRIOR TO CONSTRUCTION." I WOULD CONSIDER A FINAL EIS INCOMPLETE IF IT DID NOT CONTAIN THIS SPECIFIED PLAN FOR SUCCESSFUL RECLAMATION OF THE TAILING IMPOUNDMENT. 44-5

THANK YOU FOR YOUR CONSIDERATION.

SINCERELY

Frank Lohrer

PO BOX 984
BIG TIMBER, MT 59011

BOZEMAN, MT 59715

OCT 17 1991

Oct 15, 1991

Dear Mr Sollid,

Hello! We haven't met but I'm a new member of both the McLeod community and the Cottonwood Resource Council. For the most part, I'm a full time resident,having recently moved from New York City. I came to to McLeod in particular, like everyone else, to participate in the usual mountain sports like fishing ,hiking, riding, and hanging out with my local friends here at the famous Roadkill Cafe. In a big city, there is alot of constant change,sometimes for the better, mostly for the worse. And change usually comes in the form of more industry, subdivision, housing, and more people. I came here to get away from change.

Because I'm a new member, I'm Not really well-versed in the particulars of some of the issues of the CRC, but I do have my concerns about a mine being built up the East Boulder River. While I understand that platinum and palladium are essential for our car parts etc. and maybe eventually a mine will have to operate to satisfy our 20th century needs,I do feel that mining companies should regard their permission to mine as a privedge and not as their right.Right now, our environment is defenseless against the 1872 Mining Act,so it seems we have to work double time to ensure protection of the environs at hand. I feel that a permit to mine shall be renewable if,and only if,certain conditions are met and enforced thereafter. One of these shall be busing(not carpooling) to the mine site. This will reduce traffic, car and noise pollution. **45-1** The most important condition shall be the mandatory presence of a water treatment facility and testing to make sure that there are no more minerals in the water than there should be naturally. **45-2**

The permission to mine shall be granted only if the company officially supports the non-degradation of the East Boulder River; this includes busing for 600 workers,resolution of the road access issue and a reclamation plan for the tailings pond that will work. **45-3** It would also be a good idea if there were random visits by the forest service to enforce these conditions . ~~should take place~~. **45-4**

I do hope you'll take these into consideration, so that if there is to be change in the neighborhood,it can at least be a clean one.

Thanks very much, Mimi Kiser

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Sherm,

Here are the comments I received from the open house on 6/5/91 from Will Snyder with the GYC.

1. FS/DSL should change mitigation measures to read "PGM will" instead of should of would. **46-1**

2. Bussing-if we're truely going to require bussing, we should include in that mitigation a reduction in size of the parking lot. **46-2**

3. HEI doesn't meet Forest Plan Standards-what are we going to do in FEIS, amend FP or close roads? **46-3**

4. VQO doesn't meet FP standards-are we going to amend FP? **46-4**

5. On pg. 4-39 we state "a committment" from SPGMR is needed for surface H20 control-his comment is PSGMR will maintain. **46-5**

6. Issue an errata sheet to correct Table 2.1-1 under alt. 7. Tailings dam slope should be 2:1 NOT 1.6:1. Do this in conjunction with supplement coming out (and any other corrections brought to our attention). **46-6**

Faye

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Jo: Anybody who wishes to speak we just ask you to come up here, speak into the microphone, and slowly and carefully spell your name for us, so we make sure to get it right, and any testimony anyone wishes to give we are here to listen to it.

Dude: My name is Dude Tyler. I speak on behalf of Cottonwood Resource Council. I preface my statement by saying that some of our comments may seem redundant, and I know that we have talked about these same issues at earlier meetings, but they are important enough to us that we fell that we need to hammer on them.

Jo. Excuse me, maybe you would like to step behind the lectum so that these folks can hear ...

Dude: I don't have much to say.

Jo: That's all right.

Dude: We would like to see a bussing plan incorporated into and tied to the issuance of the final operating permit. We hope that the existance of a bussing plan using large busses and staging areas will, as a result, downsize the proposed 200-car parking lot. That's all I've got. **47-1**

Jo: OK, thanks Dude. Yes sir?

Margaret: My name is Margaret Augustine, and I live in Big Timber, Montana. The DEIS contains many examples of unclear and weak monitoring and mitigating language. Every would or could needs to be changed to "must". Effective mitigation and monitoring measures must be required as a condition of the permit. These measures must be strictly monitored and enforced and not left to the discretion of the company. **47-2** Water monitoring must be continued even if mining itself doesn't happen for years, so that an excellent baseline may be obtained. The company has said that it will obey all environmental laws now on the books. With their recent announcement that they were going to ask for an exemption of the nondegradation law, their actions belie their words. It is up to you to make sure that the EIS says very clearly what they must do. Thank you. **47-3**

Jo: Thank you very much.

Tom: My name is Tom McNamee. I am a partner in a ranch on the West Boulder River. Part in Park County and part in Sweet Grass County. I'm the author of a book called <u>The Grizzly Bear</u> which focuses on the grizzly bear population of the Greater Yellowstone ecosystem, also the author of a book on conservation philosophy called <u>Nature First – keeping Our Wild Places and Wild Creatures Wild</u>. I'm the former President of the board of the Greater Yellowstone Coalition, and I remain a member of its board, however I'm speaking not for the coalition, but for myself as a local citizen and landowner. I believe that the Draft Environmental Impact Statement does not address social effects of this project adequately. And, in fact, I think it fails to show that a project of this kind is very often, in the long run, of great harm to local **47-4**

I

communities, and I believe that the Forest Service and the State of Montana increasingly are emphasizing social impacts in their analyses of projects of this sort, and this one would profit from some serious social analysis that has so far not been done. **47-4** I would urge you, for example, to take a look at some work done by Professor Tom Power of the University of Montana, who has shown that the brightest economic future for Montana really depends on the preservation of open space, clean air, clean water, wildlife and so forth. The direct result of preservation of quality of the environment is an ongoing influx of entrepeneurs, clean industry, tourism-related industry and growth in the fishing and hunting-related businesses. All of these are capable of bringing in major economic growth that can be sustained. And these would be activities whose profits would remain, for the most part, within the state and in local communities, whereas mining is essentially colonial activity; the bulk of the profits leave the state, and local communities are, in many cases, left holding the bag. **47-5** The social and economic after-effects, once the brief burst of job creation and building and so forth has passed, there is often a tremendous social deficit left behind, and that style of boom and bust is the classic curse of the west, despite the cowboy myth of independence, Montana and the rest of the west have a long tradition of economic and social dependency, which it's been, which a lot of people who live here have managed to ignore. And I ask myself a question, when will we learn to grow our own money, and keep it here, a healthy and sustainable future for our valley and region depends on the maintenance of Montana's unique quality of life. Natural landscape, the abundant wildlife, healthy native plant communities, freely-functioning ecosystems. If we continue, on the other hand, down the road to colonialism, degradation of nature and the psychology of boom and bust, Montana's future will look a lot like the present of the rest of this country. Alienation, social conflict, ugliness, boredom, return of the indoors.

Jo: Thank you sir.

Paul: My name is Paul Hawks from Melville. I'm chairman of the Northern Plains Resource Council and I'm speaking on their behalf. Basically, I'd like to limit my comments to a couple of areas, one of which was addressed in the original EIS, and the other one relates to the draft supplement. The first one I think deals with the whole water treatment question, and potential degradation of the water up there. Um, we are not in favor of the company being granted a waiver to the nondegradation clause. We've heard many times in this very room, that the company will follow all the laws and do a good job up there, and we'd like to see them come up with a treatment facility that would keep that water as pristine as it is. That whole issue in the EIS leaves a lot of questions unanswered, I guess as far as we understand it, alternative 6A would be the one we would be in favor of, although it leaves a lot of questions unanswered. **47-6** First and foremost of which is what water are we talking about treating here? There seems to be two or three, probably three, areas that would contribute to degradation of the water; the water coming out of the adit, which I presume this treatment facility would deal with; potentially water from the percolation ponds, although I presume the treatment facility would be located above the percolation ponds and would then feed into the percolation ponds. In looking at the map of the facilities, right now there doesn't appear to be anywhere to put the plant **47-7**

above the percolation ponds, and I notice there is no place on the map presently for the settling ponds. that the plan does call for, at least it is not specified. Also, there is concern about the tailings impoundment, it's mentioned there that the tailings impoundment would definitely leak, the question is what and how much. And I guess in talking with some of the agency people, what we are hearing now is that there will probably be some water monitoring wells below this facility and that if a problem results, it will be pumped back in. 47-8 And that's also given as a method of dealing with potential septic problems. I can sort of understand the septic problems, it would be a relatively limited area, when you are talking a 105-acre impoundment facility, I guess I wonder how you can monitor all of that and pump it all back and somehow treat it. 47-9 It's also located 200 feet from the river; where would this treatment plant be, or are we talking two treatment plants? Or three treatment plants? It is not clear to me. It would that if our goal here is to keep that water clear and pristine up there, that we ought to be looking at building a treatment facility that would deal with all those potential degradation areas. I guess what we would like to see is that the EIS look at, evaluate a water treatment system that would deal with all those potential sources of degradation from the outset. 47-10 That may mean another problem with the tailings impoundment appears to be the dewatering of it. I guess I wonder if one of the alternatives shouldn't look at perhaps trying to dewater those tailings before they go in there; is that a viable alternative? Another possibility might be to design some sort of a collection system from the outset that would feed to a water treatment plant. Is that being looked at? 47-11 I guess that handles most of that. The other concern I guess would be the tailings impoundment and the reclamation and stability of that slope and the angle of that slope. We would like to see, since this new twin adit proposal has come about, it would seem to open the possibility, perhaps, of refilling one or both of those adits at the end of the project, with some of the waste rock or tailings, and potentially reduce the size of the tailings impoundment, and maybe the slope of the tailings impoundment and thereby maybe result in more likelihood of reclamation success and better impoundment stability. Thank you. 47-12

Jo.: Thank you.

Jean: My name is Jean Clark. I live in McLeod. I am a little concerned with the lack of information about reclamation in the EIS. I also feel that the reclamation bond must be adequate for the type of reclamation that will need to be done a long way down the road. I think a lot of mines are seeing that the amount of reclamation bond is questionable whether they are going to cover the cost of true reclamation. 47-13 Also, I am concerned about perhaps there could be a public review during the reclamation process. That the public could somehow get involved with whether or not reclamation has been successful. 47-14 Because the uncertainties about the timeframes involved with the start-up of this mine, the conditions under which the EIS may sometime be reexamined need to be spelled out in this document. Maybe technologies will change, maybe the makeup of the East Boulder residents will change, maybe the environment there will change. I think there needs to be more talk about if the company gets the permit, how long can they hold it in their hand. It is unclear whether or not, whether and under what conditions it will be reopened. I think that needs to be addressed in that document. 47-15 And the other thing I am really



worried about are cumulative effects of this project. I know that lately the agencies have been saying that the Stillwater Complex holds out a lot of resources for a long time down the road, not just what this particular EIS is addressing. And I don't think that it even comes close to addressing the cumulative effects of just this project next to even the other mines that might happen in Boulder drainages. I think, if we're going to be realistic about planning, size of tailings ponds, types of roads, power supplies, all of those things, we need to think about what might happen with the whole Stillwater complex. And I think that that is inadequate in this document. 47-16 Also, I would just like to express my concerns as a dude rancher on the main Boulder, because of my economic base that has been there for seventy years, and I guess we have great worries about the other economies that are built around the environment up there as it is now. 47-17

Jo: Thank you very much.

Jerry: I'm Jerry Iverson, I'm a sheep shearer and live outside of Big Timber, and on page 219 of the main EIS, there is a list of the reagents, the chemicals used in the mining process, and there is considerable amount of, 584,000 pounds of sulphuric acid, and that has to be transported from somewhere up to the mine, and I was wondering if there was any sort of plan or precautions for if there is a spill, who will pay for it, and that there is adequate preparation for the contingencies that may ensue. 47-18

Jo: OK sir.

William: My name is William Snider, and I represent the Greater Yellowstone Coalition. We are really concerned, extremely concerned, with the prospect of degrading the high-quality water in and around the vicinity of the minesite. We are opposed to any such action, and believe that the water treatment options, such as that proposed in Alternative 6A, should be further examined. In addition, more information should be provided concerning the water treatment alternatives listed in the draft. Minimum of information was provided on the water treatment alternatives, potential for hazardous waste generation, and affects on water quality, including concentrations of metals, dissolved solids, other compounds. Water resources are too important to the residents of the East and Main Boulder Rivers and to wildlife, to leave questions unanswered. 47-19 We also want to support the proposal for the 2:1 tailings impoundment. This is the only proposal that will allow any hope of full reclamation and revegetation of the impoundment. This proposal will also provide a slope of greater stability and will meet post-mining standards. 47-20 The system for dewatering the tailings pond at the end-of-life should be outlined in the operating plan, and required in order to ensure successful reclamation. Without this dewatering system, the degree and terms of consolidation, ultimate settlement will be increased, and the success of reclamation may be questioned. An alternate back-up method of dewatering the tailings pond should also be prepared, as well, as dewatering is integral to successful reclamation. 47-21 We urge the agencies to reinforce their requirement of ultimate reclamation of the tailings impoundment and of the entire mine site. Bonding requirements should be established at a sufficient level for reclamation to ensure the site is stabilized, revegetated, and restored to pre-mining land use and conditions. 47-22 We also believe a



set time limit should be placed on the permit for the validity of the EIS. Should the current low platinum prices or some other variable result in delay of development, conditions reviewed in the EIS could change significantly. We believe that if more than 5 years pass between permitting and completion of the EIS, the conditions should be reevaluated before initiation of further activity by the company. The set time limits should be included in the final. Thank you. 47-23

Jo: Thank you. Anybody else have any comments? Yes sir?

Steve: My name is Steve Pauli, I'm an outfitter here. I've also been a mine employee, and am familiar with some of their practices, and the question has always arised to me, why couldn't they enter from the Stillwater side with that boring machine that they have, and effectively take the ore zone from the other side, rather than disturbing both valleys? I understand that they do have a problem with air, having enough volume of air in there for their employees, but if they can come up with the technology to bore a huge hole through the mountain, perhaps they could come through with the technology to perhaps come up with enough air so they wouldn't disturb this valley at all. 47-24

Jo: Thank you very much sir. Anybody else? A lot of folks up there ...

Linda: My name is Linda Iverson, and I am a landscaper in Big Timber and I am also of Vice-President of Montana Native Plant Society. I have just one comment to make, well I guess an overall comment about I feel the reclamation is inadequate, and I feel that the mine should be responsible for collecting a lot of native seed that is on-site before doing any construction or removal of topsoil or anything. And I am especially concerned about Table 2.3-13, Interim Revegetation Mixture and Seeding Rates, I found out that five of the seven species are not native to Montana, and I do not, I would like to have the EIS address the effects of these non-native species. 47-25

Jo: Thank you very much. More comments? Yes sir.

Farwell: My name is Farwell Smith, I live on the Main Boulder Road just above the East Boulder River road. I am very concerned about the traffic that might result from the mine. I think that it is a result of the road is already dangerous I think we live in a rural setting and to put in a four-lane highway or whatever might be required to properly handle the increased traffic that the mine seems to propose by adding the 200-car parking lot. I think it would be a disaster. I think it would be unaesthetic, it would be unsafe, it would be extremely inconvenient for those who already live there to have to time their moves – there is only one way to go, is into Big Timber, we have no alternative road, the entire traffic to the mine would have to come up that road, there are no side roads except for the West Boulder, and it is hard to imagine that many people are going to come from West Boulder. So I think that the EIS is considerably understating the potential impact of this, and it is a very serious consideration that should be given to the mine, requiring the mine to be forced to come up with a plan that seriously limits traffic. There are a vast number of ways of doing this. You can reward workers for not driving, you can limit the parking 47-26



spaces, you can charge high parking fees, you can have mandatory bussing, I don't think we are in a position to come up with a specific program, but there are models all over the country for programs like this. I think the EIS is highly deficient in this matter. Thank you. 47-26

Jo: Thank you sir. Other comments? If there is no other oral testimony that anyone wishes to give, please remember that written testimony will be accepted until October 15, the close of business, either in Big Timber, here or Helena, so there is still time. Please do your best. Thank you very much for showing up.

### 6.1.3 Responses to Comments

| Letter and Comment Number | Response |
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| **EPA - July 15, 1991** | |
| 1-1 | Alternative 8 is the agencies' preferred alternative for the East Boulder Mine. The road route preferred by the agencies is the existing route (R1), SG31 and FS205, described in Section 2.4.2.1. The preferred powerline alternative for delivery of power to the Duck Creek Tap is Power Corridor 1, described as Alternative 5A in Section 2.4.3.3. The agencies' preferred alternative for water is treatment equivalent to 6a or 6b. The BHES will make a decision on the nondegradation petition after a formal hearing. The FS and DSL will then issue their RODs. |
| 1-2 | The citation is clearly attributed to SPGMR so as to inform the reader that the conclusion was not based on an independent analysis. Additional information regarding biodegradation potential of the processing chemicals has been added to Section 2.3.3.2. The text has been reviewed to eliminate or modify conclusions presented by SPGMR which have not been independently verified, with the exception of those contained in Section 2.3, which describes SPGMR's proposed action. |
| 1-3 | The agencies believe that an appropriate range of alternatives has been developed such that the goals of NEPA are met. In addition, the alternatives include water treatment mechanisms which are listed in the Code of Federal Regulations as Best Available Technology for drinking water.<br><br>The alternatives include one which does not degrade the aqueous environment (No-Action). Alternative 6 includes methods of water treatment, such as ion exchange or forced evaporation, which provide a high efficiency of nitrate and metals removal, such that degradation to waters would be minimized and possibly undetectable.<br><br>Other, less-efficient and less costly alternatives are presented which would result in a greater amount of degradation. |
| 1-4 | The agencies believe that the data used in evaluation of environmental impacts are sufficient in most instances. For a few exceptions, concerning for instance a lack of baseline information in the Plateau portion of the permit area (see Section 2.5.17), the agencies have noted the data deficiencies and stipulated that additional data collection measures be taken prior to mine implementation. However, none of these instances are of sufficient concern so as to prohibit development of an adequate EIS.<br><br>No specific data deficiencies or assumption are referenced in this comment. However, EPA does revisit this concern more specifically in a later comment (number 1-22). Please see the response to this comment for more information. |

| Letter and Comment Number | Response |
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| 1-5 | There is no potential for surface water in the Dry Fork to be impacted by the mining operations, and it is extremely unlikely that Canyon Creek would be impacted by the mine dewatering because fractures which could transport water are typically sealed due to secondary mineralization and due to the long vertical distance between the tunnel and surface water bodies. Section 4.2 describes potential impacts to the other referenced surface water bodies resulting from implementation of the proposed action or other alternatives. |
| 1-6 | Additional water quality information has been incorporated into the database used in the impacts analysis. Water quality monitoring locations from the Main Boulder, East Boulder, and tributaries are shown on Figure 3.2-2. Water quality information also includes data from springs, and monitoring wells and geotechnical borings. The agencies believe the data upon which the impacts analysis is based are sufficiently complete. |
| 1-7 | A map identifying surface water quality sample locations has been added to Section 3.2 (Figure 3.2-2). |
| 1-8 | Additional data have been added to the text from studies beginning in 1981 by Beak Consultants, USGS, and Hydrometrics (see Section 3.2). These data reflects data collected under various flow regimes and seasons. |
| 1-9 | Water hardness information was inadvertently omitted from the draft EIS, but has been added to Tables 3.2-1a, b, and c. Establishing toxicity was not necessary given the low levels and concentrations relative to ambient levels. |
| 1-10 | The agencies do not believe a sensitivity analysis is necessary to determine varying conditions. Rather, this EIS uses a "worst-case" approach by calculating impacts based on low river flow and other conservative conditions, such as the high discharge rate from the mine and highest reported nitrate values from the Stillwater Mine. Most conservative is the assumption that mine discharge water would be immediately mixed with the river with no dilution or reduction in contaminant loads. Because impacts, and determination of preferred alternatives, are based on such conservative assumptions, a sensitivity analysis is not required. |
| 1-11 | A calculation of the 7Q10 has been prepared so that a more appropriate low-water flow condition is used in impacts analysis. This evaluation is in Section 3.2. |

| Letter and Comment Number | Response |
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| 1-12 | A table has been prepared (Table 4.2-6) which identifies the various potential surface water degradation mechanisms for the East Boulder proposed action.<br><br>The quality of tailing impoundment water through time is not known, but a monitoring requirement is included in Alternatives 7 and 8 that specifies that impoundment water quality be checked periodically. Limited evidence from the Stillwater Mine (approximately 4 years of data) indicates that concentrations of major cations (calcium, magnesium, sodium and potassium) and some major anions (sulfate, chloride) would increase relative to their concentrations in the mine discharge water, as would hardness and total dissolved solids. Total nitrogen concentrations would increase, as may other nutrients such as ammonia and phosphorous. Major metals concentrations do not appear to increase to any great degree ("Draft Environmental Assessment for Stillwater Mine Expansion," December 1991, DSL, DHES, and USFS). East Boulder tailing impoundment water quality is expected to be similar to that exhibited at the Stillwater Mine.<br><br>Assumptions and data limitations used in analysis of impacts are included in Section 4.2. Appendix D of the Plan of Operations and the Draft Environmental Assessment for the Stillwater Mine Expansion have been provided to EPA as requested. |
| 1-13 | There should be few impacts from the waste rock at the Frog Pond area. The agencies believe there is low potential for acid drainage, but a monitoring program would be implemented to confirm this assumption. The agencies have added a modification (see Section 2.5.8) which would require SPGMR to store waste rock in the permit area at the Frog Pond if space is available. Waste rock would then be reclaimed or used to seal the shaft. If space is not available, waste rock could be disposed as described in Section 2.3.12. |
| 1-14 | According to SPGMR (communication between M. Lawson, SPGMR and J. Stephen, DSL on 12-16-91) mine water would be used for dust control within the permit area during operations and possibly during construction. Mine water would be clarified first to removed solids. Mine discharge water would not be used outside the permit area boundary.<br><br>The agencies believe the potential for evaporate deposits from dust suppression in the mine permit area to enter surface waters is low. This conclusion is based on the low concentrations of nutrients and metals in the water and the relatively low volumes of water required for this function. Also, metals and other compounds would likely be adsorbed onto soils, and some elements such as nitrogen would be removed by vegetative uptake. |

| Letter and Comment Number | Response |
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| 1-15 | A commitment to protect stockpiled soils from erosion is provided in Sections 4.3 and 4.10.1 of SPGMR's Plan of Operations for the proposed project (SPGMR 1990). Specific erosion control measures addressed include:<br><br>• location of piles outside areas proposed for disturbance<br>• pile construction with 2(H):1(V) or flatter slopes<br>• revegetation at the first opportunity with an approved seed mix and with appropriate seedbed preparation to promote successful establishment of protective vegetative cover<br>• applications of fertilizer and mulch, as necessary<br>• use of berms, sediment filters, filter windows, and/or chemical binders, as necessary |
| 1-16 | The final EIS contains considerably more detailed analysis of potential water quality effects (see Section 4.2) than the draft EIS. Refer to tables, 4.2-1, 4.2-3, 4.2-4, and 4.2-5a through 4.2-5c for concentrations of anticipated discharges and subsequent dilution and cumulative effects from mine water, impoundment percolation ponds, and runoff from the mine and adit areas. The cumulative impacts discussion of sediment effects is based on the R1R4 sediment model analysis of potential sediment changes associated with roads, mine and adit sites, and other disturbed areas. This sediment analysis is summarized in Section 4.2.2. Instream fine sediment is projected to increase by an estimated 0.2 percent in the East Boulder River over existing conditions at the Forest Service boundary. This level of sediment change is not measurable; therefore more specific sediment analysis procedures (such as maximum daily changes in sediment levels) are not warranted. |

| Letter and Comment Number | Response |
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| 1-17 | The accident rate on Montana secondary route FAS 298 is 1.20 accidents per 1 million miles travelled. SMC at Nye averages 5 trucks per week delivering toxic substances such as sulfuric acid, concentrated mill chemicals, or diesel fuel. Other trucks carry lumber, rebar, rock bolts, office supplies, etc.<br><br>In this calculation the following assumptions were used:<br>a.) Two trucks per day or 14 trucks per week which more than allows for doubling production;<br>b.) A one-way trip from Interstate 90 to the mine is about 30 miles; it is assumed that after delivery, the return trip would not carry toxic substances;<br>c.) That any accident at any point along the road would directly access the East Boulder or Main Boulder Rivers.<br><br>1,000,000 miles/ 1.2 accidents = 1 accident every 833,333 miles travelled.<br><br>833,333 miles/ 60 miles/day by 2 trucks = 1 accident every 13,899 days (38 years).<br><br>Despite its low probability, there is a potential for an accident to occur involving hazardous materials. For this reason, a spill contingency plan must be developed and approved by the agencies prior to issuance of the operating permit (see Table 2.5-1). This plan would help assure procedures are in place to reduce the environmental impact of emergencies or spills. The agencies do not believe there is any value to predicting the environmental impacts of a spill since the uncertainty as to the type of spill, magnitude, substances involved, and numerous other variables is so great. |
| 1-18 | Hardness values have been recalculated using accepted methods for Montana drainage basins. |
| 1-19 | Due to the size of the EIS, raw data and calculations were not included. They are in the project file and available for review. |

| Letter and Comment Number | Response |
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| 1-20 | The agencies are confident that mine discharge water quality from the proposed East Boulder Mine would be similar to that produced at the Stillwater Mine. The reasons for this are explained in the introduction to Chapter Four, which discusses the similarities between the Stillwater Mine and SPGMR's proposed activities at the East Boulder mine. Water quality information upon which the impacts analysis has been based has been reviewed and modified as a result of this and other comments. New evaluations of the quality of the East Boulder Mine discharge, and resultant surface water quality, are found in Section 4.2.2.<br><br>A monitoring plan would be required from SPGMR prior to mine permitting. The basic requirements for water monitoring, including tailing water and mine water discharge, are addressed in this plan in Section 2.5.5.<br><br>The data referred to in the text were collected in March of 1991 at the East Boulder River surface water sampling station EBR 5.2. Table 3.2-1 of the draft EIS displayed the metals concentrations from this sampling event. |
| 1-21 | The EPA comments are focused upon the section (Section 2.3) of the EIS that describes SPGMR's proposed action. The information in this section is based on the Plan of Operations submitted in support of the mine permit application. The agencies do not feel it is appropriate to modify SPGMR's language from the application; this section therefore reflects SPGMR's perception of what impacts may or may not occur from the proposed action. The remainder of the EIS is dedicated to the agencies' analysis of conditions and resulting consequences. The requirements described by EPA at the end of this comment (monitoring plan, impact areas, mitigation measures) are addressed in alternatives at the end of Chapter Two and the impacts analysis in Chapter Four. |
| 1-22 | All supporting calculations and assumptions used in the impacts analysis are available for public review and will be provided to the EPA. A sensitivity analysis is not believed by the agencies to be necessary or valuable. The assumptions used in the impacts analysis are fully disclosed in Section 4.2 and 4.3, and a sensitivity analysis would only be as accurate as the assumptions upon which it is based. |
| 1-23 | An analysis of the potential for streamflow disruptions is presented in Section 4.3.1. Given the large distance from the exploration tunnels to the surface waters, including Camp Lake, the potential for tapping into a connected fracture system and draining the surface waters is considered low. This issue was also addressed in the Environmental Assessment prepared prior to issuance of the exploration permit. There should be no additional effects from the production process. |

| Letter and Comment Number | Response |
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| 1-24 | The bonding for this project is anticipated to be approximately $3.5 million dollars. The agencies are confident this amount of bond is sufficient. This bond will cover the costs of implementing the final reclamation plan which is designed to protect surface water and groundwater, and to reduce the potential for tailing impoundment failures and other contingencies, as well as to cover the costs of implementing contingency plans. |
| 1-25 | The agencies are unclear as to the meaning of burst strength and loading safety factor; and therefore, we have not addressed these topics in this response. The leakage rate is based on EPA guidelines for predicted "flaw" characteristics of a liner of this thickness, properly installed. However, improper installation or loading practices could easily result in more or larger liner tears than are accounted for in the calculations. The tailing impoundment storage potential is shown on Table 2.3-3. Section 2.3.4.1 notes that "the annual tailing storage requirements would range from approximately 60,000 to 292,000 dry tons per year," equating to approximately 63,000 $yd^3$ to 309,000 $yd^3$ per year. |
| 1-26 | The ore characteristics are not provided in this EIS. This information is considered privileged to SPGMR at this time. Table 2.3-15 shows the results of leachability tests run on mill feed, mine waste, final tailing and mill concentrate although the solid characteristics of these materials are not presented. Mine waste rock, based on characteristics of the material found at the Stillwater Mine, has been characterized for acid producing potential because of concerns regarding leachate water quality. This information is presented in Table 2.3-14. |
| 1-27 | The agencies are unsure what is meant by "predictive climatology," but typical precipitation in the study area ranges from about 20 inches near the northern GNF boundary to about 40 inches on Iron Mountain. See Section 3.2.2. |
| 1-28 | Figure 2.3-7 has been taken from the SPGMR Plan of Operations, Mine Permit Application. The requested modifications have therefore not been made. The figure, as it is, accurately reflects the company's mine action as proposed. |
| 1-29 | It is not possible to specifically identify treatment alternatives for the leachate from waste rock piles that does not meet water quality standards without having some indication of the leachate water quality, although some of the water treatment alternatives described in Section 2.4.4 (reverse osmosis, forced evaporation, and ion exchange) may have relatively high metals removal efficiencies. As described previously and in the draft EIS, the agencies believe that the waste rock resulting from exploration and mining at the East Boulder Mine would not produce a leachate that is of concern to water quality. However, waste rock leachate would be monitored for this occurrence. |

| Letter and Comment Number | Response |
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| 1-30 | A geological cross-section has been added to Section 3.3, and Figure 3.2 now displays all of the ground and surface water monitoring locations used or considered in this EIS. Groundwater from the area of the proposed mine does not serve as a drinking water source. |
| 1-31 | The slope of the tailing impoundment dam as proposed by SPGMR is 1.6:1. The slope of the tailing impoundment dam in Alternative 3 is 2:1. Another, less-steep impoundment dam slope of 3:1 was considered (see Section 2.4.1.3, Alternative 3A) but rejected due to the large loss in impoundment capacity. |
| 1-32 | See Section 2.5.5 for information regarding surface water monitoring requirements. The requirements for monitoring aquatic biology are contained in Section 2.5.12.2. |
| 1-33 | Water quality would be monitored for toxicants that may be released from the mine discharge, mill effluent, or tailing impoundment. Should the surface water monitoring reveal increases in concentrations of any compounds, annual fish bioassays would be instituted to monitor toxicity potential and bioaccumulation. |
| 1-34 | See Section 2.5.5 for information regarding surface water monitoring requirements. |
| 1-35 | Under Alternative 7, SPGMR would be required to submit a water quality monitoring plan that includes monthly monitoring of surface water and quarterly monitoring of groundwater. |
| 1-36 | As noted in an earlier response (1-21) the EPA is basing conclusions upon SPGMR's proposed action, which may not reflect requirements or mitigations stipulated by DSL and GNF. For information concerning water quality monitoring requirements, see Section 2.5.5. |
| 1-37 | A biological monitoring program, equivalent to EPA Rapid Bioassessment Protocols, would be instituted above and below the mine site, if permitted. See Section 2.5.12.2 for information regarding this program. |
| 1-38 | The most stringent limiting factor with respect to nitrogen oxide emissions is the Class II PSD increment, which is an annual average. Therefore, the modeling that was required and the emission limitation proposed are on an annual basis. (Although the project is not a PSD source, $NO_2$ increment would be consumed because the baseline data have been triggered on a statewide basis.)<br><br>The term "manufacturer's information" is meant to refer to verifiable and certifiable emission information on the equipment to be used or similar equipment under similar operating conditions. This type of information would be gathered by approved performance testing, possibly in another state. The purpose of this condition is to allow the agency to accept representative data in lieu of on site testing if these data are determined to be acceptable. |

| Letter and Comment Number | Response |
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| 1-39 | Condition L, of the Preliminary Determination sets forth a reporting requirement relative to the operation. For clarification, a specific requirement to include chemical stabilization activities has been added. Language has also been added to clarify that an on-going record keeping system relative to those items be maintained on-site in addition to the annual submittal. |
| 1-40 | Condition L, including the additions noted above, is intended to provide the necessary record keeping and reporting. |
| 1-41 | Beginning at the bottom of page 6 of the analysis portion of the Preliminary Determination, is a discussion of the tailing impoundment. General requirements with respect to temporary and permanent closure are addressed there. |
| **EPA - October 9, 1991** | |
| 2-1 | The additional 28,000 cubic yards of waste rock that would be generated under Alternative 8 (Twin Production Adits) is a one percent increase over the amount of waste rock that would be produced under the proposed action over the life of the mine. The 12 percent increase in waste rock mentioned on page 4-15 of the supplemental draft EIS refers to the increased amount in waste rock from constructing two 13-foot diameter twin adits versus one 16-foot-diameter adit. The text has been modified to clarify this difference (See Section 4.5.8.1). |
| 2-2 | See responses to comments 1-1 through 1-41. |
| **Department of the Interior - July 2, 1991** | |
| 3-1 | The issue of bird collisions is addressed in Section 4.6.2, which states that "No impacts to raptors are expected from the upgraded transmission line since it would use Rural Electric Association (REA) approved raptor proof design," and Section 4.6.5 states "New poles would be designed and installed to avoid bird electrocution" and "To the extent possible, construction would avoid wetlands and riparian zones." The agencies believe these measures proposed by SPGMR are adequate protection for raptors and other birds. |
| 3-2 | A wildlife and fisheries monitoring plan would be approved by the Forest Service and DSL prior to permit approval (See Section 2.5.12.2). The Big Timber District or Gallatin National Forest (contract biologist) currently surveys on an annual basis for peregrine falcons during the time of year when they are most visible. Accessible areas considered highly suitable peregrine habitat are surveyed. |

| Letter and Comment Number | Response |
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| 3-3 | A portion of the Stillwater Ultramafic Complex has been nominated by the National Park Service as a National Natural Landmark (NNL) due to its unique geological characteristics. Although nomination as a NNL does not provide any legal framework of protection, it is important that the integrity of the complex be retained. The complex, which extends for a length of nearly 28 miles, has proven reserves of platinum group metals and known subeconomic reserves of chromite. The Stillwater Mine at Nye, Montana, near the eastern edge of the complex, is currently permitted to mine 1,000 tons per day of platinum and palladium ore. Because this is an underground mine, surface disturbance on the complex is limited to several small-diameter openings (adits) that access the ore body. The proposed East Boulder project would also be an underground mine, with access to the ore body coming from one or two small-diameter adits to be driven from outside the complex. Impacts to the complex itself are limited to several small openings and breakouts needed for mine ventilation.<br><br>Based on the small amount of proposed disturbance to the surface of the complex by this project, the impact to the unique features and the integrity of the proposed NNL is minimal. |
| 3-4 | The agencies agree that the 1.6:1 slope is considered sufficiently "safe" according to criteria developed by the Army Corps of Engineers (1982; see final EIS Section 4.5.3). The modified tailing impoundment slope (2:1) was proposed to improve potential for adequate reclamation. The modified slope is also estimated to be more stable than the 1.6:1 slope.<br><br>The agencies would like to point out that the tailing dam slope at the Stillwater Mine is 2:1, not 1.6:1 as noted in the comment. |
| 3-5 | The FS and DSL acknowledge there would only be a slight difference in visual comparison between a 1.6:1 and a 2:1 slope. As discussed in Section 4.12.3, both slope angles would exceed the Partial Retention Visual Quality Objective. However, the lower 2:1 slope angle would improve the probability of revegetating the embankment slope. Also, contrary to bullet No. 2, SPGMR did not propose to enhance revegetation of the embankment slope. |

| Letter and Comment Number | Response |
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| 3-6 | The estimated lifetime of 27 years for the mine was developed by SPGMR based on their understanding of the area geology and mineral resources. A 2.5 year reduction in mine life caused by a 2:1 tailing dam configuration would represent a loss in mine life of less than 10 percent, using the estimated numbers. This value is not considered significant given the large initial uncertainty in estimating mine life.<br><br>However, as described in Section 2.4.1.3 of the EIS, no other area in the vicinity of the mine is considered acceptable for a tailing impoundment from an engineering and environmental perspective. If in the future SPGMR proposes to continue mining beyond the impoundment capacity and requires additional area for tailing storage, a new analysis of environmental impacts would be required. But, there is no known location in the vicinity of the permit area that would be suitable for tailing disposal. |
| 3-7 | It is estimated that approximately 517,000 $yd^3$ of additional embankment fill, above that needed for SPGMR's proposal, would be required to construct the modified tailing impoundment (2:1 dam slope). Using SPGMR's estimate of 3.6 million $yd^3$ waste rock for construction of the proposed dam, this represents an approximate 14 percent increase in embankment fill to 4.1 million $yd^3$. Given SPGMR's estimate of 3.85 million $yd^3$ of waste rock generated during mine life, there could be a shortfall in impoundment construction material. However, a shortfall would not be confirmed for many years into the mining project, and if it occurs additional coarse material would have to be obtained from another source, possibly from ancillary tunnels blasted into host rock. |
| 3-8 | The salvage of soil or growth media materials prior to any mine-related disturbance is required by the DSL. The need for a soil survey of the proposed facilities' locations on the East Boulder Plateau would be determined in consultation with the agencies on a site-by-site basis. The final EIS, Section 4.4.7, has been modified to reflect this approach to determining the need for soil surveys on the East Boulder Plateau. |
| **Department of the Interior - October 16, 1991** | |
| 4-1 | Comments on the supplemental draft EIS are noted. |
| **U.S.D.I. Fish and Wildlife Service - June 14, 1991** | |
| 5-1 | U.S. Fish and Wildlife Service concurrence with the biological assessment is noted. If final project design is changed so as to have effects on threatened or endangered species other than those noted in the May 1991 biological assessment, or if the conservation measures designed to minimize adverse impacts to listed species are not fully implemented, a revised biological assessment would be prepared. |
| 6-1 | A creel survey is included in the wildlife and fisheries monitoring plan (See Section 2.5.12.2). The purpose of this creel survey is to monitor any change in fishing pressure on the East Boulder River due to this project. |

| Letter and Comment Number | Response |
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| 6-2 | SPGMR intends to maintain minimum historic flows in the East Boulder River. Monitoring of the flows would occur just downstream of the diversion prior to any flow augmentation by tributary streams. |

**Montana Department of Fish, Wildlife, and Parks - October 15, 1991**

7-1 Alternative 8, Twin Production Adits, would reduce the volume of mine water produced by approximately 10 to 20 percent over the proposed action (refer to Section 4.3.8) and would reduce the sediment yield by approximately 1 percent over the proposed action (refer to Section 4.2.8), resulting in reduced impacts to aquatic resources of Brownlee Creek as noted in your comment.

Your concerns raised in response to the original draft EIS have been addressed, please refer to responses to comments 6-1 and 6-2.

**Department of Natural Resources and Conservation - September 17, 1991**

8-1 Thank you for clarification of SPGMR's rights to East Boulder River water in light of downstream users. It should be noted that both the permit application to divert East Boulder River water and the permit application to appropriate water from adit construction were published for three weeks in local newspapers for public review.

8-2 It is true that mine discharge water may contain elevated nitrate levels as blasting occurs in active stopes. It was assumed in the analysis that these nitrates would reach groundwater. Also, the Water Quality Monitoring Plan required by the agencies would ensure that any cumulative impacts from using this water in various applications can be monitored. (See also response to comment 1-14.)

**Tyler - Cottonwood Resource Council - June 5, 1991**

9-1 In letters to the DSL and GNF dated 10/24/90 and 8/29/91, SPGMR committed to utilizing a bussing program to reduce projected traffic and associated road maintenance. This bussing program is now part of the proposed action, and the text has been amended to reflect this change (refer to Section 2.3.18). In addition, the agencies would require that further details on the bussing plan be submitted and include such information as the location of staging areas in Big Timber and/or other towns. This additional information would not required until implementation of the project since it is dependent on where employees actually locate.

The proposed parking lot has been downsized due to the bussing plan. The parking lot would accommodate approximately 85 cars, and the size of the lot would be approximately 1.5 acres, depending on the final design of the lot.

| Letter and Comment Number | Response |
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| 9-2 | The agencies have incorporated several mitigation measures in Alternative 7 to improve the safety of the tailing impoundment dam. Please refer to Section 2.5.11, which addresses further geotechnical testing required by the agencies to provide for adequate assessment of impoundment stability, and groundwater level monitoring to identify potentially harmful flow paths. In addition, Alternative 7 includes a 2:1 tailing dam slope which, based on the Modified Bishop factor of safety (used by engineers to analyze the stability of a dam), would increase safety by 12 percent relative to the proposed 1.6:1 tailing dam slope (refer to Section 2.4.1.2). Both slopes, however, meet minimal acceptable engineering standards. |
| 9-3 | The agencies propose a 50/50 combination of rock armor and resoiled/revegetated cover for stabilizing the 2:1 tailing dam outslope (Section 2.5.6.1 of the EIS). Use of the rock armor in strips across the slope should break the slope into reduced slope-length segments, without the use of terraces. The reduced slope lengths reduce the potential for excessive erosion. In addition, the use of rock armor strips is preferred because terracing would require either a larger tailing impoundment footprint, therefore increasing disturbance, or a reduction in impoundment capacity. |
| 9-4 | The draft EIS in Section 2.3.20.8 erroneously identifies an average two-inch distribution depth of salvaged and stockpiled soil to be used in reclaiming disturbed areas within the East Boulder permit area. Based on the estimated 478,160 bank cubic yards of soil available for salvage within the East Boulder permit area (Noel and Houghton 1990), a level 200 acres of disturbance could be covered with salvaged soil to an approximate depth of 28 inches. The agencies estimate the redistribution depth may be slightly less than 28 inches due to the extent of 2:1 slopes to be covered and the loss of salvageable soil due to the presence of some large boulders. However, the use of rock to cover portions of the tailing dam outslope in, place of soil, would counter much of the anticipated increased demand to maintain 28 inches of soil on the increased surface area of disturbance represented by the tailing dam slope. Actual soil redistribution depths would be governed by the extent of rock-cover use over disturbed surfaces. The agencies believe the proposed 28-inch soil depth would support successful reclamation. The text in the final EIS has been modified to clearly identify the availability of soil sufficient to cover the disturbed areas with approximately 28 inches. |

| Letter and Comment Number | Response |
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| 9-5 | Alternative 6A is technologically feasible. Reverse osmosis is a relatively common method of wastewater treatment. However, careful planning would still have to be conducted to determine exact configuration of the treatment units. This would likely require bench-scale laboratory testing and possibly a demonstration test at the mine site.<br><br>Detailed design plans for a facility at the East Boulder project would not be developed until a determination is made to use this technology. But, wastewater treatment engineering is relatively standardized, and a conceptual design based on typical facilities has been included in Section 2.4.4.1. Additional information has been added to the text as well, including an estimate of the size of the facility in Section 2.4.4.<br><br>The preliminary costs for this technology (as presented in Section 2.4.4.1) are based on a number of design estimates such as water quality, flow rate, power needs, etc., and should not be evaluated for any purposes other than as a comparison to the other cost estimates. DSL and GNF have prepared an independent analysis of the costs presented by SPGMR in their petition to the Board of Health and Environmental Sciences. This information has been added to Section 2.4.4.4.<br><br>Economic feasibility of implementing this alternative is difficult to ascertain, since it requires the use of proprietary information to complete an analysis of the mine profit margin which, in turn, depends on market factors during mine life. The system start-up cost may not be prohibitive when considered against other mine exploration, permitting, and start-up costs. |
| 9-6 | The construction of a treatment facility would result in some surface disturbance. The amount of sediment eroded from this additional surface disturbance would depend on site-specific factors such as soil type, slope, total area disturbed, and whether construction occurs during rainfall events. The trade-offs from the construction would depend on these factors, the type of treatment facility to be built, and these site-specific conditions. Generally, the construction impacts of the treatment facility would be short-term and may be masked by the sediment export from the construction of other mine facilities. At any rate, best management practices to control erosion and prevent sedimentation to the river would be employed. |

| Letter and Comment Number | Response |
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| 9-7 | The U.S. EPA has established a drinking water standard of 10 mg/l for nitrogen, in the nitrate form. The sources of the nitrates are the adit water and the septic system. The expected water quality from the major source (adit water) has been estimated at approximately 10 mg/l based on monitoring from the Stillwater Mine (See Section 4.2). This level of nitrates is at or near the drinking water standard. Because upgradient groundwater and upstream surface water would dilute the adit water, the resulting nitrate concentrations in the East Boulder River should be significantly lower than the 10 mg/l anticipated in adit water.<br><br>The drinking water criterion (10 mg/l) is based on the toxic effects of nitrate to lactating and pregnant women, and infants under the age of 6 months. Young children are the most sensitive due to the presence of nitrate-reducing bacteria in the digestive tract. The projected nitrate concentration in the East Boulder River would not adversely impact use of this water for drinking water purposes.<br><br>At any rate, the health concerns expressed in this comment should be alleviated by the understanding that the drinking water standard developed for protection of human health cannot be exceeded by the mine. Also, the Board of Health and Environmental Sciences is prohibited from allowing a discharge which results in an exceedance of any water quality standard. |
| 9-8 | A cost-benefit analysis has not been conducted that compares the proposed action with the water treatment alternatives. It is difficult to develop an analysis that evaluates the benefits of public health versus costs to reduce potential health risks, because there are such widely variable opinions on what is an acceptable level of risk. Nevertheless, the Board of Health and Environmental Sciences will consider the potential risks to human health and the environment versus the benefits of treatment costs when it reviews SPGMR's petition.<br><br>Estimated costs for varying levels of water treatment are provided in Section 2.4.4. Estimates of water quality resulting from the different treatment methods have been developed for Section 4.2.6. |
| 9-9 | The agencies have determined that the existing route, SG31 and FS205, is their preferred alternative. The Gallatin National Forest has jurisdiction over activities occurring in the Forest on FS205, while Sweet Grass County has jurisdiction on SG31. The Hard Rock Impact Plan being developed for this mining project will assign responsibilities and funding requirements for SG31, addressing such issues as road widening, improvements, operation and maintenance, and plowing. |

| Letter and Comment Number | Response |
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| 9-10 | Potential socioeconomic effects to residents adjacent to the existing access road to the East Boulder Mine project (SG 31 or Valley Route) are discussed in Section 4.14.2.9. The socioeconomic effects of the project to these residents would result primarily from the mine related traffic on the road. There is a potential for impacts from additional noise, accidents, and dust. Given the responses to the scoping process and subsequent public comment and response, it is clear that many of these residents feel that the use of the Valley route would substantially affect their way of life. The magnitude of these impacts would be in some measure dependent on SPGMR's bussing program (see Section 2.3.18) and the success of mitigation measures. |
| 9-11 | The Forest Service has identified two multiple use activities which may be impacted by mine development. First, a possible timber sale in the Wright Gulch may be scaled down or eliminated. This reduction would result from a combination of factors relating to elk habitat effectiveness (i.e., existing road density and use, and forage/cover ratios). The East Boulder area is very near the Gallatin National Forest Plan limit for elk habitat effectiveness index. (see Section 4.6.2). Possible mitigation measures might include closing the road from the "keyhole" that goes up into the East Boulder timber sale area. Second, post and pole harvest activity in the drainage would likely be reduced. Currently post and pole activity is occurring in the proposed tailing pond area and in several areas up the East Boulder to create small clearings for wildlife habitat in areas of dense lodgepole.<br><br>Increased recreation use is expected in the Dry Fork because of its close proximity and ease of access for mine personnel. This may make grazing in the Dry Fork more difficult to manage (i.e., gates left open or cattle inadvertently moved around), but there is expected to be no effect on numbers of cattle or season of use in the area. There would be no reduction in Animal Unit Months (AUMs).<br><br>Other impacts of the mine, including cumulative impacts, are discussed by resource in the EIS. |

| Letter and Comment Number | Response |
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**J. Clark, P. Clark - Cottonwood Resource Council - July 7, 1991**

10-1 The No-Action Alternative is an option that the Forest Service and Department of State Lands have the authority to choose; hence, it is a viable alternative. In choosing this option, the agencies would be denying the mining company an operating permit for the particular Plan of Operations as submitted; they would not be denying the company the right to mine. The company could submit a new Plan of Operations for approval. The U.S. Forest Service has the ability and responsibility to ensure operating permits have appropriate environmental safeguards.

The 1872 Mining Law provides the right to claim the benefits of mineral extraction and processing. However, environmental protection is required under various other laws, including the Clean Air Act, Clean Water Act, Endangered Species Act, and others. If a particular reclamation plan proposed on Forest Service-controlled lands were to cause unnecessary and undue environmental degradation, the Forest Service has the authority to deny the particular plan.

DSL has similar responsibilities under the Montana Metal Mine Reclamation Act, but also has authority to deny a mine permit if adequate reclamation cannot be undertaken, or if air quality or water quality laws would be violated.

10-2 SPGMR submitted an emergency response plan (Appendix H of the Plan of Operations) for on-site emergencies. Emergency response plans outside of the permit boundary may be prepared and negotiated as part of the Hard Rock Impact Plan, as you noted. SPGMR has informed DSL that it would respond to emergency situations outside the mine permit area that involve potentially hazardous materials originating at the mine or destined for use at the mine. A mitigation measure has been added to Alternative 7 (Section 2.5.16) requiring SPGMR to provide the agencies with a copy of procedures to be followed in the event of an accidental spill on Forest Service property outside the permit boundary or along SG 31 so that the agencies may evaluate the effectiveness of these procedures in preventing or reducing harm to the environment.

| Letter and Comment Number | Response |
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| 10-3 | Degradation of water on National Forest Lands is governed by both the Clean Water Act and the State of Montana Water Quality Act. Several permits are required including a 404 Permit under the Clean Water Act (33 U.S.C. 466 et seq.), a Montana Pollutant Discharge Elimination System Permit (MPDES), and a Montana Groundwater Pollution Control System Permit (MGWPCS).<br><br>Under the Metal Mine Reclamation Act, if the mining operation disturbed senior water rights, the mining company would be required to replace the loss with water of equal quality and quantity.<br><br>The conditions that are applied to SPGMR's permit to appropriate East Boulder River water subject them to existing senior water rights and certain Yellowstone River Basin reservations, including the Department of Fish, Wildlife, and Parks in-stream flow reservation. Please see clarification in comment 8-1 from the Billings Water Rights Field Office. |
| 10-4 | The permit issued to SPGMR does not allow the mine to appropriate all water down to a level of 5 cfs during the life of the project or throughout the entire year. Rather, SPGMR's water right is subject to existing senior water rights and an instream reservation for maintaining ecological facets of the river. See also comment and response 8-1. |
| 10-5 | The flow would be measured just downstream of the diversion before any tributary inflow occurs. Spring flow monitoring is included in the water quality monitoring plan (see Section 2.5.5). |
| 10-6 | SPGMR has already applied for and obtained a permit to appropriate up to 500 gpm of water resulting from adit construction. The use for this permit includes 100 gpm for industrial use, 100 gpm for pollution abatement, and 300 gpm for sprinkler irrigation on 260 acres. Most of this water would eventually make it into the groundwater system and into the East Boulder River. |
| 10-7 | The U.S. Geological Survey is responsible for classifying areas as Known Geothermal Resource Areas (KGRA), where there is an indication of geothermal potential. This area is not within a KGRA. In addition, many other geothermal studies and inventories have been carried out by various agencies and groups to assess the overall geothermal resources of the United States. The East Boulder area and plateau are not considered to be a geothermal area in these studies' results. |

| Letter and Comment Number | Response |
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| 10-8 | With a few exceptions, the agencies have chosen to rely on the environmental information presented in SPGMR's Plan of Operations as a basis for impacts analysis. The baseline data were collected by a number of different parties under the direction of SPGMR and in consultation with the Forest Service and other agencies. However, the determination of potential impacts on the identified environmental resources has been developed almost entirely by specialists within the DSL, Department of Health and Environmental Sciences, the GNF, and the agencies' independent consultants. |
| 10-9 | The explanation of water treatment alternatives has been somewhat expanded due to the prevalence of comments requesting more information. See Section 2.4.4 for more information concerning water treatment methods, including the size, configuration and cost of treatment facilities. |
| | A double-lined tailing impoundment, consisting of two synthetic liners separated by a drainage and leak detection system, is not considered an appropriate alternative to reduce or eliminate impacts to groundwater and surface water resources. A double layer of synthetic lining is commonly required in land impoundments for disposal of certain hazardous wastes regulated under the Resource Conservation and Recovery Act of 1976, as amended. Some states have chosen to require this technology for mine projects, principally those using cyanide leach processes. The agencies did not consider requiring a double-liner technology for this project for a number of reasons. First, based on information from the Stillwater Mine, the tailing water quality at the East Boulder is expected to be relatively innocuous with respect to metals and nitrates. Although some leakage through the liner is expected to occur, the amount should be minor. Second, most of the nitrates or other compounds of concern would enter groundwater and surface water through the percolation pond or septic system. Finally, leak detection would be established through shallow groundwater monitoring wells located just downgradient from the impoundment. |

| Letter and Comment Number | Response |
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| 10-10 | Please refer to Section 2.3.3.2 for a discussion on the reagents. This section has been updated in the final EIS to address, as much as possible, the concerns expressed in this comment.<br><br>There is little information available to allow a confident prediction as to fate of the spent processing chemicals. Although most of the chemicals are expected to break down through time either by photodegradation, chemical reaction with other compounds, or biodegradation, no data exist for a project comparable to the East Boulder. The Stillwater Mine tailing liquid is expected to reflect the chemistry of the East Boulder tailing liquid, but organic chemical analyses have not been run on Stillwater samples to determine the fate of the mill chemicals.<br><br>The water quality monitoring plan in Section 2.5.5 requires that SPGMR establish a program for monitoring tailing liquid quality and groundwater near the impoundment. Concentrations of total organic carbon, phosphorous, sulfur and other compounds would be evaluated to monitor water quality and provide an indication of the fate of the spent chemicals. |
| 10-11 | Additional information has been included in the text (see Section 2.4.4) to describe possible water treatment methods. Also, the draft EIS does not state that the waste <u>would</u> be hazardous. This determination could only be made once the treatment plant is operational. However, if residue from a treatment process is considered hazardous, it could require additional treatment, such as solidification, and disposal in a permitted hazardous waste facility. |
| 10-12 | See response to comment 10-9. In addition, the impoundment would be designed with a bottom collection drain over the liner, sloped so that liquid could be collected and sampled to assess quality. |
| 10-13 | An evaluation of impacts to streambed morphology (shape) is included in section 4.2.2. The amount of water diverted or added to the East Boulder River should not noticeably alter channel morphology. Reclamation, if any is required, of stream beds should occur very quickly after mine operations cease. Spring thaws and high runoff flows would rapidly control the shape of the East Boulder River. |
| 10-14 | The 2:1 slope is the agencies' <u>preferred</u> tailing impoundment alternative. If this alternative is chosen, the tailing impoundment reclamation mitigation measures outlined in Section 2.5.6.1 would be required. |
| 10-15 | See response to comment 9-4. |

| Letter and Comment Number | Response |
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| 10-16 | The agencies agree that the similarities between the Stillwater Mine and the proposed East Boulder mine play an important role in this EIS. A summary of these similarities and important differences has been added to the beginning of Chapter Four, since the Stillwater analogy is used most often in evaluating potential environmental impacts resulting from the East Boulder Mine.<br><br>Information regarding the Stillwater mine, a copy of the Stillwater Project Final Environmental Impact Statement, December 1985, is available from the Montana Department of State Lands or the Custer National Forest. The recently issued "Draft Environmental Assessment" for the Stillwater Mine proposed expansion (December, 1991) is also available from the agencies. |
| 10-17 | The DSL has the responsibility for determining the adequacy of reclamation for metal mines within the State of Montana as mandated by state law (Title 82, Chapter 4, Reclamation, Part 3). The law requires the DSL to ensure for all disturbed lands the establishment of vegetative cover, soil stability including chemical stability, water condition, and safety condition appropriate for the proposed subsequent use of the area. The subsequent use of the disturbed lands must be of comparable utility and stability as that of adjacent areas. Reclamation information is available for public review.<br><br>The reclamation plan for the East Boulder Mine project is part of the East Boulder Project Plan of Operations, as amended by responses to completeness reviews (SPGMR 1990), which was submitted to DSL and GNF for review, comment, and ultimate approval prior to initiating the EIS process. A summary of this plan is found in Section 2.3.20. The Plan of Operations is on file with the agencies and is available for public review. The EIS incorporates portions of the Reclamation Plan contained in the Plan of Operations directly or by reference.<br><br>Reclamation is an evolving process - requirements incorporated in a reclamation plan often change as reclamation proceeds and adjustments are made to optimize potential for success (Title 82, Chapter 4, 337). This flexibility is important to allow on-site testing and application of new reclamation techniques as they are developed. It is also pointed out that the reclamation bond is adjusted when the plan is altered. |
| 10-18 | Reclamation is an ongoing process which begins during the construction phase of the project. After an area is disturbed, it is revegetated as soon as possible to prevent surface erosion, enhance the visual quality of the site, and provide forage for wildlife. If the mine shuts down early, the final reclamation plan would be implemented at that time. The law (Title 82, Chapter 4, 336) requires that reclamation be completed within two years after completion or abandonment of the operation in its entirety or any portion unless authorized otherwise by the State authority. See also response to comment 10-17. |

| Letter and Comment Number | Response |
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| 10-19 | As part of permit approval, the Jackpine EA weed control plan (Appendix G, the Noxious Weed Management Plan) would be updated to current location and conditions. This updated plan would be reviewed and approved by the Forest Service and the Sweet Grass County Weed Board. This plan would be continued during mine development, operation, and reclamation phases of the project.<br><br>The Weed Control Plan as submitted for the Jackpine EA included annual inspections, mapping of infestations, weed treatment, and monitoring of effectiveness. These measures would be conducted using approved control techniques (i.e. chemicals cleared for use near riparian areas where necessary, as per the Gallatin Noxious Weed EIS). To retard initial infestation as much as possible, the Jackpine EA Weed Control Plan states that SPGMR would require all contractors using heavy equipment to wash the equipment prior to commencing on-site work. These and other appropriate weed control measures would be updated and included in a revised weed control plan to be developed prior to approval of mine development.<br><br>The focus of the required revisions would be the immediate revegetation of all new disturbances where soil is to be left exposed in addition to best management practices for chemical weed control. SPGMR would be required to prepare an annual report which identifies all areas of weed infestation and describes specific types and results of implemented control measures. |
| 10-20 | In accordance with 40 CFR 1506.10(c) the agencies must allow not less than 45 days for comments on the draft EIS from the date of publication of the Notice of Availability in the Federal Register. The draft EIS was published on May 10, 1991; therefore, the comment period extended to June 24, 1991. However, due to a change in the proposed project after publication of the draft EIS, a supplemental draft EIS was prepared, also subject to the 45-day requirement. The supplemental draft EIS was published on August 30, 1991; therefore, the comment period extended to October 15, 1991. Because some information needed to evaluate the supplement was provided in the draft EIS, the time period for public comment on the draft was also extended to October 15, 1991.<br><br>As described in Section 2.6 of the supplemental draft EIS, approximately 28,000 cubic yards of additional waste rock would be generated under Alternative 8. Also described in Section 2.6 and depicted in Figure 2.6-2 of the supplement, the location of the new adit would be parallel to the main adit at a distance of approximately 25 to 50 feet. |
| 10-21 | Please refer to Section 2.7 of the EIS, which describes how the Stillwater IRA has been incorporated into this process. |

| Letter and Comment Number | Response |
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| 10-22 | This question seems aimed at commodity resource development or use that might be curtailed by development of the East Boulder Mine. Effects of the mine on wildlife, recreation, and other non-commodity resources are discussed in those portions of the EIS.<br><br>The natural topography of the East Boulder area somewhat isolates this mine project in relation to other proposed projects. Considering potential commodity projects in the East Boulder River drainage, a possible timber sale in the Wright Gulch may be scaled down or eliminated. This reduction would result from a combination of factors relating to elk habitat effectiveness (i.e., existing road density and use, and forage/cover ratios). The East Boulder area is very near the Gallatin Forest Plan limit for elk habitat effectiveness index, (See Section 4.6.2). Possible mitigation measures might include closing the road from the "keyhole" that goes up into the East Boulder timber sale area.<br><br>After mine development, post and pole harvest activity in the drainage would likely be reduced. Currently post and pole activity is occurring in the proposed tailing pond area and in several areas up the East Boulder to create small clearings for wildlife habitat in areas of dense lodgepole.<br><br>Increased recreation use is expected in the Dry Fork because of its close proximity and ease of access for mine personnel. This may make grazing in the Dry Fork more difficult to manage (i.e., gates left open or cattle inadvertently moved around), but there is expected to be no effect on numbers of cattle or season of use in the area. There would be no reduction in Animal Unit Months (AUMs). |
| 10-23 | The DSL and GNF are responsible for securing a reclamation bond based on engineering estimates of what the reclamation would cost if the State were required to implement the reclamation plan for a mine complex. The bond amount includes additional funds beyond the strict reclamation costs to account for anticipated extra costs for the State to contract and manage the reclamation work. The bond documents are available for public review once finalized. The bond requirement is likely to be about $3.5 million. |
| 10-24 | No time limits will be set on either the EIS or the operating permit since neither NEPA nor MEPA regulations require such time limits. However, in accordance with 40 CFR 1502.9 a draft or final supplemental environmental impact statement would be prepared 1) if there is a substantial change in the proposed action, 2) if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts, or 3) when the agency determines that the purposes of NEPA will be furthered by doing so. |

| Letter and Comment Number | Response |
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| 10-25 | A report on the springbeauty (released after publication of the draft EIS) which addresses the distribution of populations in the project area, the East, Main, and West Boulder River drainages, and other parts of the Gallatin National Forest has been prepared and is available at the Big Timber District office. Sections 3.8.3 and 4.8.2 in the final EIS have been updated to incorporate this new information.<br><br>Because many large populations and subpopulations were found in the East Boulder River drainage, as well as other locations, the agencies would not require SPGMR to monitor this species. The Forest Service however, does monitor threatened endangered and sensitive species that occur on the forest and updates their list annually. |
| 10-26 | See response to comment 9-1. |
| 10-27 | A list of major equipment is included as Table 2.3-7. No staging area is anticipated for trucks or large equipment in the Big Timber area, except for busses transporting workers to and from the mine site. SPGMR has preliminarily determined that staging areas for worker bussing would be appropriate in Big Timber, and possibly Livingston and/or Columbus. Specific staging locales have not been identified and cannot be identified until project implementation since it would depend on where concentrations of workers reside. |
| 10-28 | Environmental impact statements (and this EIS) summarize proposed activities. Detail regarding those activities is contained in the many volumes of SPGMR's Plan of Operations and application to mine. These documents are available for public review in Big Timber at the District Ranger's office and in Helena at the Department of State Lands. SPGMR's application was deemed complete in August 1990, indicating that the agencies determined sufficient information was available to evaluate environmental impacts and make permitting decisions.<br><br>During EIS development and public comment, questions have arisen which required the collection of additional information or analysis. This has resulted in the addition of more information to the description of alternatives, affected environment, and a more complete analysis of impacts. The more detailed water monitoring program and bussing plan cited by the commentor are two examples of the manner in which the EIS has evolved.<br><br>The Record of Decision for this project will not be made until after the EIS is published and the Board of Health and Environmental Sciences has made a determination regarding SPGMR's nondegradation petition. This should allow additional time for public input to the agencies. |

| Letter and Comment Number | Response |
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| **Tyler - Cottonwood Resource Council - Received July 11, 1991** | |
| 11-1 | See response to comment 9-5 and revised text in Section 2.4.4 of the final EIS. A wastewater treatment facility schematic has been included in the final EIS, which, since these technologies are commonly used and well understood, should suffice as information on what a typical facility looks like and how it operates. No site-specific design would be conducted unless water treatment is required. |
| 11-2 | Spring flow monitoring is included in the water quality monitoring plan (See Section 2.5.5). |
| 11-3 | SPGMR would drill small diameter probe holes ahead of drift advance when geological conditions suggest that higher-than-normal groundwater flows may be encountered. Such conditions would include geologic contacts, shear zones, and known fault traces, such as Brownlee Creek. The decision to grout or use other containment methods would depend on the volume encountered and the expected duration. Permanent flows would be routed to the portal and discharged. SPGMR has a permit to appropriate up to 500 gpm of water resulting from adit construction, which is subject to senior existing water rights. Please see comments and responses 8-1 and 8-2. |
| 11-4 | The 2:1 slope configuration for the tailing dam outslope is the agencies' preferred alternative. Approximately 28 inches of soil would be redistributed over all disturbed areas not covered by rock (see response to comment 9-4). The agencies are concerned about the reclaimability of the proposed impounded tailing; therefore, mitigation measures outlined in Section 2.5.6.1 of the EIS would be required if either Alternative 3, 7, or 8 is chosen. |
| 11-5 | See response to comment 9-1. |
| 11-6 | See response to comment 10-24. The agencies cannot predict possible future environmental regulations. New regulations often have grandfather clauses which may or may not apply to this project. If new regulations are applicable to this project, SPGMR must comply. |
| 11-7 | As explained in responses to comments 9-11 and 10-22, two other activities in the East Boulder drainage would likely be affected by the East Boulder Mine project. These are the Wright Gulch timber sale and post and pole harvesting. |
| 11-8 | The agencies would ensure the company complies with all mitigation measures required in the chosen alternative and those required in the Jackpine Environmental Assessment Decision Notice (Appendix B). Mitigation measures are designed to protect the environment and public safety. |

| Letter and Comment Number | Response |
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**Tyler - Cottonwood Resource Council - Received September 10, 1991**

The agencies would like to provide an introductory comment regarding this letter and comment responses. The letter represents notes taken during a meeting between citizens and citizen groups and agency representative on August 17, 1991. While technical details expressed in Mr. Tyler's notes are often correct, the suggestion in some notes/comments that the agencies have made specific decisions is inaccurate. For instance, in response to comment 12-11, no decision has yet been made regarding the final slope of the tailing dam embankment. The agencies have expressed preferences with respect to many issues such as dam slope, mitigations, and road location in compliance with MEPA/NEPA. However, final decisions will not be made until the agencies have signed the Record of Decision. In instances where Mr. Tyler's notes are not accurate, corrections have been made in the following responses.

12-1 See responses to comments 9-5 and 11-1, and revised text in Section 2.4.4 of the final EIS.

12-2 This comment addresses a very complicated, but possibly inevitable, result of development whether by industry or private citizens. The EIS has described potential impacts resulting from the mine septic system. Nutrients including phosphates and nitrates could be added to the groundwater, and possibly be discharged into the East Boulder River. It was also described in Section 2.4.4 that contamination emanating from a septic field could be intercepted by recovery wells and pumped to a treatment system. Further discussion of the problems associated with this form of solid waste disposal has been added to Section 2.4.4.

A cumulative impact analysis of this problem, incorporating downstream contributors and future development scenarios, has not been funded. However, such a study would likely be hard to undertake because of the potential impact mitigating measures could have on some portions of the population, particularly recreation homes, ranchers and farmers.

12-3 Separating groundwater flows encountered in the adit and other development workings from water encountered in the active stopes may not be practical from an operating standpoint. Mine discharge water would probably be mixed and sent to the proposed percolation pond. If additional treatment facilities are required, SPGMR may find that it becomes practical to separate water from the stopes that might be carrying nitrates and to discharge separately so that smaller volumes are treated.

12-4 There are alternatives to using nitrates in blasting material, however these alternatives contain mercury which is worse for the environment than nitrates. Therefore, no alternative blasting materials would be considered for this project.

| Letter and Comment Number | Response |
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| 12-5 | SPGMR would be required to develop a plan to address the potential for acid mine drainage if Alternative 7 or 8 is chosen (see Section 2.5.8). The plan would address the regular sampling and analysis of waste rock during mine development to monitor the potential for acidic conditions, possibly resulting in metal contaminated leachate. In addition, the water monitoring plan (see Section 2.5.5) would detect acidic conditions. The water monitoring plan includes sampling and analysis of mine water drainage; the long-term maintenance of the percolation ponds as effective mine waste water retention/treatment facilities; the long-term maintenance of constructed surface water drainages; long-term monitoring of groundwater conditions including seepage fluids from the percolation ponds, tailing impoundment and dam, and septic drain field. These plans would include responses to any adverse condition which could develop and be identified during the monitoring and maintenance efforts noted above. Provisions for adequate bonding apply to all efforts noted above with the exception of waste rock analyses. |
| 12-6 | The stipulation in the exploration permit requiring the company to stop at known, mapped faults and drill ahead with test holes to look for water is also included as part of the Plan of Operations. |
| 12-7 | See response to comment 8-1. |
| 12-8 | See response to comment 1-7. Figure 3.2-2 has been added showing the water monitoring locations. |
| 12-9 | See response to comment 10-2. |
| 12-10 | The tailing impoundment leak detection system is passive, consisting of downgradient monitoring wells near the perimeter of the impoundment. These wells would be sampled on a frequency documented in an approved monitoring plan. Samples would be analyzed for the presence of a variety of compounds. These include organic indicator compounds such as total organic carbon, which could indicate releases of chemicals used in the ore milling and concentrating process. Inorganic elements such as nitrogen and heavy metals would be checked as well. |
| 12-11 | The 2:1 slope is the agencies' preferred tailing impoundment alternative. If this alternative is chosen, the tailing impoundment reclamation mitigation measures outlined in Section 2.5.6.1 would be required. Also, as discussed in response to comment 9-4, approximately 28 inches of soil would be available for use on disturbed areas not covered by rock. |
| 12-12 | Dewatering the tailing impoundment is included in SPGMR's reclamation plan (see Section 2.3.20.7). Prior to reclamation, a dewatering plan would be submitted to the agencies for approval. SPGMR would be required to use the best dewatering method available at the time of closure based upon site-specific studies. |

| Letter and Comment Number | Response |
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| 12-13 | It would be impractical to return additional tailing to the mine above that coarse fraction that is already being used to backfill stopes. The only open areas for backfilling would be the adits or tunnels, which have to remain open for ventilation, and mine access and escape. Excess, unreclaimed waste rock or tailing that remains at mine closure could be used to backfill adits that are no longer needed. |
| 12-14 | See response to comment 9-1. SPGMR has committed to a bussing program; thus traffic projections have been changed in the final EIS to reflect this commitment. The size of the parking lot has been reduced to approximately 1.5 acres to accommodate approximately 85 vehicles . The busses to be used would carry somewhere between 40 to 60 passengers. |
| 12-15 | The agencies' preferred route to the mine is the existing SG31. Some of the required upgrades to SG31 and FS205 are discussed in Sections 4.10.2 and 4.10.4 of the final EIS. |
| 12-16 | See response to comment 10-24. |
| **Bruce - Montana Wilderness Association - June 25, 1991** | |
| 13-1 | After evaluating SPGMR's proposal and determining potential environmental impacts, the agencies developed a list of mitigation measures. These mitigation measures, which include by reference the mitigation measures in the Jackpine Environmental Assessment Decision Notice (as amended), along with SPGMR's proposal constitute Alternative 7. Section 2.5 describes Alternative 7. Alternative 8 incorporates all the modifications and mitigations included in Alternative 7. If either Alternative 7 or Alternative 8 is chosen in the Record of Decision, SPGMR would be required to abide by all of these mitigation measures. Additionally, SPGMR is required to abide by the conservation measures outlined in the Biological Assessment. |

| Letter and Comment Number | Response |
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| 13-2 | This EIS has addressed cumulative impacts for most resources. The methodology for cumulative impact analysis is presented in the introduction to Chapter Four and based on the evaluation of other projects in the Stillwater Complex as presented in Section 2.6 of the draft EIS (now Section 2.7 of this final EIS). This type of cumulative impact assessment is based primarily on spatial or chronologic relationship of the various projects. For instance, the cumulative impacts assessment for surface waters is based on geographic (spatial) location. Only projects in the same drainage basin as the East Boulder project were evaluated for cumulative effects. |
| | However, the comment appears to address the degree of cumulative impact analysis conducted for the wildlife in the surrounding area, including the Absaroka-Beartooth Wilderness. This analysis is presented in Section 4.6.9. Analysis of impacts to wildlife cannot be bounded as easily as most resources, since many species undergo seasonal migrations often involving large distances. Also, although subtle impacts such as shifts in land-use patterns may be somewhat predictable, the extent of change is usually not. Impacts to other wildlife or habitat resulting from a shift in use patterns would be very difficult to predict. The impact to an area's overall biodiversity because of projects like the East Boulder mine is an objective of cumulative effects analysis; unfortunately, no acceptable methodology for such an analysis was known to be available for this project. Therefore, the cumulative impacts assessment is in places somewhat qualitative, based on the best professional judgement of the wildlife specialists involved. |
| | Quality of the wilderness experience may be based on among other things the user's perception of the degree of solitude, aesthetics, remoteness of the area and distance from development. The cumulative effects of large-scale developments including existing and proposed mining ventures surrounding the Absaroka-Beartooth Wilderness may have an impact on the user's perception. As additional areas are developed adjacent to the Absaroka-Beartooth Wilderness, the size of the area that emits the desired aesthetic quality and perception of solitude or remoteness may be reduced to its interior. |
| **Hawks - Northern Plains Resource Council - July 10, 1991** | |
| 14-1 | SPGMR has already applied for and obtained a permit from DNRC (Permit No. 43BJ-75494) to appropriate up to 500 gpm of water resulting from adit construction. This permit is subject to senior existing water rights. |
| 14-2 | See response to comment 10-4. |

| Letter and Comment Number | Response |
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| 14-3 | There are three reasons why the agencies believe that the mine exploration program, using the tunnel boring machine (TBM), would not impact surface water bodies. First, the main adit would be located at an average elevation of approximately 6,500 ft msl. Canyon Creek and Camp Lake are situated more than 1,500 ft above where the adit would be driven. It is extremely unlikely that there would be an open connection between these surface waters to where the tunnel would cross the Canyon Creek Fault (Canyon Creek runs in the surface expression of the Canyon Creek Fault zone). The geology of the fault system is the second reason. Most faults or fractures have secondary mineralization which fills in the open spaces. This usually occurs because groundwater flowing through the opening "deposits" minerals that crystalize in the voids, filling up the space. This is why it is very common to see faults with calcite or quartz filling. Finally, the manner in which SPGMR drives the adit should prevent drainage of surface water bodies even in the unlikely event there is an open connection. Holes would be drilled in advance of the tunnel boring machine to identify the presence of water. The company would grout fractures and water drains to reduce the amount of fluid in the adit.<br><br>However, it is not known whether there is a hydrologic connection between the surface water bodies and where the adit would be driven. This can only be determined when the tunnel is developed. The tunnel could not be rerouted to avoid fault zones. This area and the entire Stillwater Complex is riddled with faults and fracture systems.<br><br>As is stated in Chapter Two of the text, the exploration phase of the East Boulder Mine project, including development of the main adit, has already been permitted. Concerns about impacts to surface water bodies, including Camp Lake and Canyon Creek, resulting from mine exploration were addressed in the Jackpine EA (See Appendix A). |
| 14-4 | The discharge at the East Boulder mine would be monitored in accordance with the approved water monitoring plan (see Section 2.5.5). |
| 14-5 | Fourteen years of post-mining water treatment is only an estimate used for costing purposes. It is based on the understanding that concentrations of nitrates and metals in mine discharge water would decrease over time when blasting and mining cease. However, the actual determination to stop water treatment would not depend on a set time period, but rather discharge water quality. At some point after mining stops the mine discharge water would reach normal or background quality, or would be sufficiently clean that no treatment would be required. |

| Letter and Comment Number | Response |
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| 14-6 | See responses to comments 9-5, 10-11, and 11-1. Additional information regarding wastewater treatment facilities has been included in Section 2.4.4. Final engineering design information for a treatment facility for the East Boulder project cannot be developed without better quantification of such information as mine water discharge rate and water quality. The only way to define these parameters is for the drilling and mine development program to proceed so that water quality, flow rate, and other critical design criteria can be determined.<br><br>The design information referred to above would not be actively distributed to the public. However, all such information is public information which is available at the DSL and GNF offices. If any changes are made requiring an additional environmental document, the EIS mailing list (see Section 6.2) would be used for distribution of new information.<br><br>As discussed in response to comment 9-6, additional surface disturbance would occur should a treatment facility be constructed, but erosion control practices should minimize sediment displacement and runoff. The facility would be sited in the permit area. |
| 14-7 | The plan referred to in this comment would be submitted to the agencies for approval at the end of mine life. SPGMR's bond would include this expense. Refer to Section 2.5.1 for further information. |
| 14-8 | This comment refers primarily to the makeup and disposal of waste generated by a water treatment system. The reader is referred to Section 2.4.4, which has been expanded to provide the information requested in this comment. In summary, the exact makeup of a waste from a treatment facility would be unknown until treatment begins. This uncertainty cannot be resolved by looking at existing, operating treatment plants because all wastewaters are unique, with different concentrations of chemicals requiring removal. Therefore, it is also unclear whether the waste would be characterized as hazardous, requiring special handling and disposal according to environmental regulations. In accordance with these regulations, the public would have the opportunity to participate in any decisions regarding disposal of hazardous wastes generated by the mine. |
| 14-9 | Forced evaporation was considered as one of many possible alternatives for water treatment so as to provide a range of treatment process options. Forced evaporation is not proven for nitrate reduction, but it does concentrate nitrates into a smaller, possibly more manageable, effluent material. |
| 14-10 | Disposal of 700 $yd^3$ per year in the tailing impoundment could inhibit reclamation efforts. Adjustment of the pH through soil additives and nutrient additions should suffice to allow full reclamation. If the tailing impoundment leaks, some additional chlorides (salts) would likely get into the groundwater since they are relatively soluble. Soil sampling at reclamation time would identify needed soil amendments. |

| Letter and Comment Number | Response |
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| 14-11 | Pretreatment of mine discharge water using a sand filter or membrane filter to remove suspended solids can be very effective at reducing nitrate concentrations since a relatively large percentage can be adsorbed onto the solid particles filtered out. |
| 14-12 | International Engineering Company, Inc. (IECO) prepared an engineering report on the tailing impoundment for the East Boulder project. This report, Addendum D of SPGMR's Plan of Operations, includes an analysis of impoundment seepage which is dependant on several variables including the thickness of tailing deposit which increases over time. By Year 3, estimated seepage is 0.01 gpm (5,256 gallons per year); by Year 8, estimated seepage is 0.08 gpm (42,048 gallons per year); by Year 13, estimated seepage is 0.17 gpm (89,352 gallons per year); by Year 20, estimated seepage is 0.20 gpm (105,120 gallons per year); and by Year 28, estimated seepage is 0.39 gpm (204,984 gallons per year).<br><br>See response to comment 12-10 regarding monitoring of leachate.<br><br>SPGMR has prepared a petition requesting the Board of Health and Environmental Sciences grant a modification of existing water quality which could result, in part, from seepage from the tailing impoundments. |
| 14-13 | Final plans for treatment of contaminated water have not been developed. As described in earlier responses and in the EIS text, a decision regarding the need to treat water is pending the Board of Health and Environmental Sciences determination regarding SPGMR's request for a modification of existing water quality. SPGMR would be required to submit final plans and specifications of all water treatment facilities to the agencies, demonstrating how the concentrations authorized by the Board would be achieved. |
| 14-14 | The purpose of the impoundment monitoring program is to test the quality of the liquid in the impoundment and also determine how much liquid is being retained in the tailing. Because some seepage from the impoundment would occur, and leaks would likely develop, monitoring wells would be installed just downgradient of the impoundment so that groundwater quality can be assessed periodically. If groundwater appears to be degraded, a pumpback system could be installed to collect contaminated groundwater and route it to a water treatment facility, if installed. Also see Section 2.5.3. |
| 14-15 | See response to comment 12-3. |
| 14-16 | See response to comment 12-2; also see Section 4.2.2. |
| 14-17 | See Section 2.5.8 and response to comment 12-5. |

| Letter and Comment Number | Response |
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| 14-18 | As described in Sections 2.3.20.8 and 4.2.2, the rock types to be encountered during exploration and production at the proposed East Boulder Mine are fairly well defined, and it is not anticipated that lithologies which would cause acid mine drainage or acidic leachate would be found. However, if waste rock does generate acidic leachate a treatment process would be required which likely entails pH adjustment through lime addition. The leachate probably could not be directed through a wastewater treatment facility without pH adjustment, unless the treatment facility was designed in anticipation of this occurrence. Section 2.5.8 describes a requirement that SPGMR develop a plan for monitoring acid formation potential in waste rock and preventing acidic runoff. Also see response to comment 12-5. |
| 14-19 | See comment and response 12-4. |
| 14-20 | See responses to comments 9-5, 10-9, 10-11, 10-12, and 11-1. Additional information has been added to Section 2.4.4 to address some of the concerns noted. However, specific details of a treatment plant design cannot be provided without exact information on such parameters as mine water discharge quality and flow rate. The values used in the text are estimates; a treatment plant design would be done after adit development.<br><br>If a treatment plant were constructed, it would be designed to handle the maximum flow from the mine with some additional factor of safety. The mine discharge water would contribute the majority of water requiring treatment. |
| 14-21 | See responses to comments 9-4 and 11-4. |
| 14-22 | SPGMR has not submitted a final tailing impoundment design; the information evaluated in the EIS is from a preliminary geotechnical evaluation and general siting plan in the Plan of Operations. Final design for the tailing impoundment would be developed after approval of the mine operating permit and would be available for public review. The agencies consider the preliminary plans sufficient for the evaluation process. |
| 14-23 | See response to comment 12-12. |
| 14-24 | All water treatment including the percolation ponds would be bonded until mine drainage and impoundment seepage meet effluent requirements as defined by the Montana Water Quality Act (Title 75, Chapter 5 MCA). |
| 14-25 | See response to comment 12-13. |

| Letter and Comment Number | Response |
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| 14-26 | Modifications to the project Reclamation Plan contained in the Plan of Operations would be required by the agencies as listed in mitigations in Alternative 7, if Alternative 7 is the chosen alternative. Reclamation efforts on the East Boulder Plateau (Placer Basin area) would be guided by site-specific plans based on field assessments conducted in cooperation with the agencies. These individual plans would address key efforts including soil salvage, storage, redistribution, and revegetation, particularly appropriate seed mix selection. |
| 14-27 | The tailing impoundment would be reclaimed with visual modifications to harmonize with surrounding landscape elements. The measures would include the selection of a variety of vegetation to reduce color and texture contrast. The measures would not hide the facility. It would remain visually evident and would not meet the prescribed Visual Quality Objectives (VQO) (see Section 4.12.2). There are no mitigation techniques available for the impoundment to meet the Forest Service VQO. However the contrast between the facility and the surrounding landscape would be less obvious as prescribed by the Partial Retention VQO (see Table 3.12-1 for a definition of "Partial Retention VQO"). |
| 14-28 | The Modification VQO above Camp Lake is a result of a previous mining disturbance, the Frog Pond Adit. |
| 14-29 | Tailing pond settlement of up to two feet would have serious adverse impacts on reclamation success in those areas where settling occurs. This would lead to collection of rainwater and ponding on the surface for periods of time. Impoundment stability is not expected to be affected. Mitigation measures outlined in Section 2.5.6.1 of the EIS establishes those procedures to be followed prior to closure which would enable SPGMR to develop final reclamation design criteria for approval by the agencies. |
| 14-30 | Reclamation of the tailing dam outslope or embankment is addressed in Section 2.5.6.1 of the EIS. Revegetation of the embankment is included as a mitigation measure. |
| 14-31 | See response to comment 9-4. |
| 14-32 | See response to comment 10-18. |
| 14-33 | A strict refuse control program to avoid attracting bears to the mine site is a mitigation measure included in Alternative 7. This mitigation measure, among others, was required under the Jackpine Environmental Assessment Decision Notice, as amended (Appendix B). The mitigation measures from the Jackpine EA were incorporated by reference in Alternative 7 in the draft EIS, but have been restated for clarity in the final EIS (see Section 2.5.12.1). SPGMR would be required to abide by all mitigations outlined in the chosen alternative(s).<br><br>Furthermore, the Biological Assessment requires refuse control to limit or avoid potential conflicts with the threatened grizzly bear. |

| Letter and Comment Number | Response |
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| 14-34 | The tailing impoundment would be fenced to prevent wildlife intrusion. The text has been changed to clarify this (see Section 2.5.12.1). |
| 14-35 | The proposed emergency response plan would be for accidents or emergency response within the mine permit. Emergency response plans outside of this boundary may be prepared and negotiated as part of the Hard Rock Impact Plan. However, SPGMR has informed DSL and GNF that it would respond to emergency situations outside the mine permit area which involve potentially hazardous materials originating at the mine or destined for use at the mine. |
| 14-36 | The company would not be required to post bond for cleanup costs should the tailing impoundment dam fail. The possibility of dam failure is so remote that requiring a bond is not reasonable or prudent. The company would be required to prepare a contingency plan identifying potential impacts and mitigation measures should the dam fail. This plan would be part of the final engineering design and would be part of the public record for this project. Additionally, the company would be responsible for any damage that occurs in the event of dam failure. Dam failures generally consist of slipping or slumping with little impact to the surrounding environment. |
| 14-37 | See response to comment 9-1. |
| 14-38 | Staging areas in Big Timber and possibly other towns would be for the employee bussing program. The agencies would not require each delivery truck to unload at a designated staging area for consolidation with other loads. |
| 14-39 | See response to comment 9-1. |
| 14-40 | A bussing plan has been proposed which would reduce the average daily traffic (ADT) significantly (see the revised text in Section 4.10.2). For FS 205 the ADT during operations would be below the 200 ADT level which is the general breakoff point used to determine whether or not a paved road is, in the long run, more economical than maintaining a gravel road. The implementation of a bussing plan would be taken into consideration when designing FS 205 upgrades. |
| 14-41 | The agencies decision will include selection of an access route. |
| 14-42 | There are not any plans at this time to upgrade FAS 298 between 8-mile bridge and McLeod. The state highway department is currently designing plans for the reconstruction, overlaying, and widening of FAS 298 between Big Timber and 8-mile bridge. Monies for highway improvement come from the secondary road fund, which is a combination of federal and state money. The section of highway between 8-mile bridge and Mcleod currently supports the legal load limits for roads of its type and no special load limit signing is planned. |

**J. Clark, P. Hawks - Northern Plains Resource Council - October 15, 1991**

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| 15-1 | See responses to comments 14-1 through 14-42. |

| Letter and Comment Number | Response |
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| 15-2 | Exact descriptions of the water treatment alternatives are not possible at this time, as explained in earlier comments including 10-9, 10-11, 10-12, and 11-1. The agencies believe that sufficient information is available for the alternate powerline routes to make a decision. Also, the road alternatives have been extensively considered and impacts fully evaluated. |
| 15-3 | The water treatment alternatives present a range of potential impacts on surface and groundwater resources, from no degradation (no action alternative) to no measurable or minimal degradation (reverse osmosis alternative) to lessened degradation (ion exchange) to the SPGMR proposal which results in more groundwater or surface water degradation than the treatment alternatives. The alternatives include the demonstrated best available technology for nitrate reduction in drinking water, according to EPA, and even reverse osmosis would result in some water degradation. |
| 15-4 | See Sections 4.2.6 and 4.7.6. |
| 15-5 | The agencies have considered the creation of artificial wetlands as a treatment for mine discharge water; however, because it is not a proven treatment to remove nitrates from mine drainage, and because the only reasonable site for creation of a wetlands is near the East Boulder River (the agencies have concerns about locating artificial wetlands near the river), artificial wetlands have been eliminated from further consideration. |
| 15-6 | The monitoring capabilities of SPGMR reflect the capabilities of the analytical laboratories with which the mine contracts. The detection limits that can be employed by a particular lab varies according to the various methods that are utilized. Generally, efficient, cost effective, and EPA-approved methods can be used to determine the ambient levels of chemicals in the East Boulder River. |
| 15-7 | See responses to comments 1-35, 1-36, and 1-37. |
| 15-8 | Water flow data have been collected in the East Boulder River for more than four years, although the information was not adequately presented in the draft EIS. Section 3.2 has been expanded to include additional baseline water information collected throughout the 1980s.<br><br>The appropriateness of the data depends on the information that is needed from the data. For example, a general estimate (i.e. central tendency, variability) of the flow distribution in the East Boulder River could be calculated based on these four years. Calculations regarding important characteristics used in determining permit requirements have been redone using the entire database. These reevaluations can be found in Sections 3.2. Section 4.2 represents the estimates of stream degradation (impacts) using the new calculations. |

| Letter and Comment Number | Response |
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| 15-9 | Monitoring wells would be designed to allow evaluation of vertical flow components through the aquifer. |
| 15-10 | Baseline monitoring would proceed in a statistically sound manner, keeping in mind what information needs to be produced from the data. The present sampling locations have been chosen with a sampling strategy in mind. Sampling would continue through mine start-up, at least until mine closure activities are complete. |
| 15-11 | Routine water quality and biological monitoring will be conducted in the East Boulder River. This level of monitoring would be adequate to detect any impacts from the proposed operation. Pending selection of final water treatment design and ambient concentrations selected by the BHES, the monitoring program would include sampling of key indicator parameters in the Boulder River. |
| 15-12 | The amount of degradation which could result from implementation of the proposed action is very small. Influent concentrations have been predicted (see Section 4.2.2) for the area of impact on the East Boulder River. However, concentration increases would not be seen at a relatively short distance downstream, due to the high dilution effect of the East Boulder River. Also, there is no known likely development to occur on the East Boulder River that could be evaluated for cumulative impacts. |
| 15-13 | Additional water quality information has been incorporated into the database used in the impacts analysis. Water quality monitoring locations from the Boulder, East Boulder and its tributaries are shown on Figure 3.2-2. Water quality information also includes data from springs, and monitoring wells and geotechnical borings. The agencies believe the data upon which the impacts analysis is now based are sufficiently complete. |
| | Estimates of adit water quality are based on 76 and 69 samples for nitrate and ammonia, respectively, collected at the Stillwater Mine from 1986 to 1991. Estimates of dissolved metals are based on fewer samples, which were taken during the period from 1990 to 1991. The reason fewer samples were taken is that SMC modified their water treatment system in 1990, making earlier samples incomparable to the East Boulder Mine. Furthermore, detection limits changed during this period. Sample sizes vary for each parameter but are based on a minimum of three samples at low detection limits and 9-12 samples at higher detection limits. |
| 15-14 | The statements from page 2-30 of the draft EIS have been taken from the mine permit application. They reflect SPGMR's view of the proposed action and its potential environmental impacts. The agencies do not accept SPGMR's statements as fact. A review of the impacts analysis contained in Chapter Four reveals many areas of concern to the agencies regarding environmental consequences of the proposed action. The backup to support the statement regarding water quality standards (Section 2.4.4) is contained in Section 4.2 and Section 4.3. |

| Letter and Comment Number | Response |
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| 15-15 | Please refer to Section 2.3.18 for a description of the bussing plan. This plan is now part of SPGMR's proposed action.<br><br>If Alternative 7 or 8 is chosen, SPGMR would be required to submit a Tailing Impoundment Failure Plan (See Section 2.5.11). This plan would not have to be submitted to the agencies before the issuance of an operating permit, however, the plan would have to be approved by the agencies. The plan would be part of the public record for this project. See response to comment 14-36.<br><br>Section 3.4.2 describes soil conditions and types at the three disturbance sites, including an estimate that 487,000 bank $yd^3$ of soil are available for reclamation. See response to comment 9-4.<br><br>A plan for monitoring waste rock is described in Section 2.5.8. This plan would identify steps to be taken should waste rock with acid generation potential be encountered. See response to comment 12-5.<br><br>Other monitoring plans' goals and standards are included in this final EIS, such as wildlife (Section 2.5.12.2) and water (Section 2.5.5). The agencies do not prepare monitoring plans; rather they set goals and standards that SPGMR must meet. All monitoring plans must be approved by the agencies and become part of the public record for this project upon approval. |
| 15-16 | See response to comment 12-5. The exact chemistry of runoff from waste rock piles is not known, although similar conditions at the Stillwater Mine indicate the leachate should not be acidic or high in metals values. The monitoring requirement described in Section 2.5.8 requires leachate monitoring and development of a contingency plan to address acidic runoff. |
| 15-17 | Bonds would be determined before issuance of an operating permit. Also, see responses to comments 10-23 and 14-24. |
| 15-18 | Refer to Section 4.2.2, 4.2.7, 4.2.8 and 4.7.2, 4.7.7, 4.7.8 for a discussion of the cumulative impacts from activities at the East Boulder Mine on water quality and aquatic life. |
| 15-19 | See responses to comments 6-2, 8-1, and 10-4. |

| Letter and Comment Number | Response |
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| 15-20 | The design of the tailing impoundment is discussed in Section 2.3.4 and 3.2.2. The dam is designed to contain 1/2 PMF (Probable Maximum Flood). The 1/2 PMF is larger than either the 100-year or 50-year flood event. This design criteria is conservative, and has the holding capacity for both the 50-year and 100-year storm events. A specific contingency plan for overflow is not required; however, the design of the dam would include a contingency for overflow (e.g. a permanent ditch around the facility).<br><br>See responses to comments 1-12 and 14-14 regarding monitoring of tailing impoundment water. |

| Letter and Comment Number | Response |
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| 15-21 | Section 26.4.108, Abandonment or Completion of Operations, of the rules implementing Montana's Metal Mine Reclamation Act addresses the issue of temporary closures. That section states that the operation is presumed to be "abandoned or completed (and thus subject to the reclamation time schedules outlined in section 9 of the act) as soon as ore ceases to be extracted for future use or processing. Should the permittee wish to rebut said assumption, he must provide evidence satisfactory to the Board [delegated to the Commissioner of State Lands] that his operations have not in fact been abandoned or completed." Six situations including workers strikes or seasonality of operations are listed. The rules then state that the Board [Commissioner of State Lands] has the discretion to determine the following conditions are satisfactorily met:<br><br>• evidence that valuable mineralization still exists;<br>• continued employment of a maintenance crew;<br>• or information on commodity prices, costs, etc., which may show that mining may soon resume on a profitable basis.<br><br>The permittee is required to provide maintenance on all environmental protective structures such as diversion ditches. Mines are required to perform temporary revegetation of disturbances like soil stockpiles. If water treatment were necessary, the mine would be required to perform that treatment during shutdown. Regular site inspections by agency personnel would occur which would ensure that environmental degradation did not occur. Should a problem be encountered, the company would be ordered to take immediate remedial action. If the company were unable to do so, the agencies would take emergency action. Agency actions of this type are paid for out of special funds such as the Fines, Fees and Penalties Fund.<br><br>The Final Reclamation Bond cannot be used for temporary shutdown. However, it would be sufficient to perform all final reclamation necessary at the particular stage of mine development, should the mine be determined "abandoned."<br><br>The Hard Rock Impact Act also addresses temporary shutdowns. Forty percent of the county's share of Metalliferous Mines tax monies collected under the HRIA are reserved for use when 50 percent or more of the work is laid off. These funds are deposited in an interest bearing fund and can only be used by the local government to mitigate social impacts of layoffs or closures. |
| 15-22 | The operating permit will include contingency plans, mitigation measures, and special conditions included in the chosen alternative which will be identified in the Record of Decision. |

| Letter and Comment Number | Response |
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| 15-23 | The text which is referred to is based on Administrative Rules of Montana (ARM), section 16.20.704, which have been adopted by the Board of Health and Environmental Sciences to administer the Nondegradation Policy (75-5-303, MCA). A range of alternatives have been presented that would result in no degradation or less degradation (ARM 16.20.704(3)(e)). Additional alternatives may also be available.<br><br>SPGMR has not requested an exemption from the nondegradation rules but rather a modification of ambient quality that would not violate standards or impair beneficial uses (ARM 16.20.704(3)(j)). Therefore, the agencies feel this action is consistent with both the Administrative Rules and the Water Quality act. |
| 15-24 | MEPA supplements all statutes, not just the Metal Mine Reclamation Act. Therefore, a MEPA analysis is needed for any petition for a limited waiver of nondegradation to the Board of Health and Environmental Sciences (BHES).<br><br>As stated in Chapter One, the purpose of this EIS is to evaluate the effects of several related proposed actions. This EIS has been developed jointly between the Gallatin National Forest and Department of State Lands, with assistance from a number of agencies, most principally the Department of Health and Environmental Sciences. To say the EIS can not evaluate alternatives is to suggest that MEPA does not apply to the Board's decision making process.<br><br>If NPRC disagrees with the rules implementing the Water Quality Act or MEPA, and believes the type of analysis presented in this EIS should be prohibited, NPRC should petition the Board for a change of rules. However, the agencies believe the process conducted in this EIS is appropriate and in compliance with the law.<br><br>With regard to "inadequate data," additional information has been incorporated into the water quality database in Section 3.2 which reflects monitoring from years prior to SPGMR's involvement on the project, and also the most recent data from 1991.<br><br>The assumptions used to evaluate environmental consequences in this EIS are based on data to the largest extent practicable, and the best professional judgement of the resource specialists involved. |
| 15-25 | The last sentence of ARM 16.20.704(1) clearly states that "....the procedures of this sub-chapter are also available to operators of pollution sources not subject to permit requirements," such as mining operations, in compliance with the Metal Mine Reclamation Act (ARM 16.20.1012(1)(j)). |
| 15-26 | No cost-benefit analysis has been conducted for the alternatives. The agencies believe that the process of compliance with this aspect of the nondegradation rules rightly rests with the Board of Health and Environmental Sciences in the petition proceedings. |

| Letter and Comment Number | Response |
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| 15-27 | The factual basis that NPRC questions is presented in numerous sections of the EIS where comparisons are drawn between the Stillwater Mine and anticipated conditions at the East Boulder project. However, in order to make the similarities more clear, information has been added at the beginning of Chapter Four which summarizes the basis for these comparisons and consequent assumptions.<br><br>Briefly, the zone to be mined is a continuance of the Stillwater Ultramafic Series, the same rocks being mined at the Stillwater mine. Because of this, and the fact that the mining and milling activities are almost exactly comparable, the properties of the ore and waste materials produced at the East Boulder would be very similar to those produced at the Stillwater Mine. The Stillwater Mine therefore provides an excellent analog for the East Boulder which allows, for most resources, a more confident environmental analysis than is typically possible. |
| 15-28 | See response to comment 12-5. |
| 15-29 | More hydrological data have been added to the EIS for delineation of baseline environment and as a basis for impacts analysis. Baseline information is found in Section 3.2; the impacts based on the reevaluation of hydrologic data are found in Section 4.2.<br><br>There is no way to predict more accurately than has been done the amount of water the East Boulder mine workings would produce. Additional hydrologic data would not help. The only way to know is by proceeding with exploration. However, the estimates of mine water discharge used in the EIS are believed to be conservative, based on the best professional judgement of the resource specialists. This conservatism helps to ensure that environmental safeguards such as proposed mitigations and plan modifications would withstand worst-case conditions. |
| 15-30 | The use of Stillwater Mine data in evaluating the East Boulder mine project and its consequences is considered well-based by the agencies. The similarities between the Stillwater Mine and proposed East Boulder Mine are many, as described in the introduction to Chapter Four. The Stillwater Mine provides much more "real" information about the proposed mine area than is normal for a new mine application. |

| Letter and Comment Number | Response |
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| 15-31 | Nondegradation policy and rules apply to new or enlarged sources of pollution such as the proposed East Boulder Mine Project. These rules allow degradation after a demonstration of necessary economic and social development by the applicant (ARM 16.20.702(2)). The granting of a petition does not constitute an exemption from the nondegradation rules. <br><br> The calculations and measures referred to on page 4-14 of the draft EIS are for the proposed action, prior to the implementation of additional mitigating measures. The commentor does not appear to understand the conclusions of the analysis: Under worst case conditions, and without implementation of additional mitigating measures, an exceedance of the iron standard in the Clean Water Act as adopted by Montana could occur. In addition, drinking water standards are not mentioned. |
| 15-32 | At present, there is no regulatory requirement that a groundwater discharge for the East Boulder Mine project be permitted for real or possible discharges to the East Boulder River. However, three items are worth considering regarding this concern. First, the Board of Health and Environmental Sciences will be considering SPGMR's petition for modification of ambient water quality. This EIS will be used by the Board in making their decision. The Board may decide to set compliance standards which will limit, as a permit might, the amount of degradation allowed to the East Boulder River. Second, the permit boundary will be considered the groundwater monitoring compliance location and the proposed permit boundary does not extend to the East Boulder River, except in two limited areas. Third, SPGMR already has an NPDES permit that regulates their discharges to the East Boulder River. See Section 2.8 for a discussion of the limitations on discharges to surface water and groundwater. |
| 15-33 | The statements referenced do not reflect a policy of either the Department of State Lands or the Gallatin National Forest. They merely reflect a factual analysis of the fact that groundwater discharge would result in contaminant adsorption and dilution of pollutant concentrations, thereby reducing the impact on the East Boulder River when compared to direct discharge. That the agencies understood the import of this analysis is shown in the very next sentence, which acknowledges the violation of Montana's nondegradation rules as applied to groundwater. |
| 15-34 | A mitigation measure has been added to Section 2.5.3 requiring periodic cleaning or scraping of the percolation pond to prevent clogging. |
| 15-35 | See response to comment 14-36. |
| 15-36 | The reclamation bond required is approximately $3.5 million dollars. See also response to comment 10-2. |

| Letter and Comment Number | Response |
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| 15-37 | See the discussions regarding nondegradation and mine permitting in the responses to comments 15-23 and 15-25. The technologies described in Alternative 6A are very well understood. If this alternative is required under the permitting and nondegradation decisions, an engineering analysis would be conducted to describe the efficiency of this treatment method with respect to the water being treated. |
| 15-38 | Seepage rates for the tailing impoundment were calculated in a report produced for SPGMR by International Engineering Company, 1990. The seepage rate referred to is an estimate, not a known quantity, but it is based on properties of the liner material, the amount of liquid overlying the liner and the permeability of the tailing solids, and the typical flaw rate of liner installations.<br><br>The agencies believe that the Stillwater Mine information provides an excellent analog for what would be expected from the proposed East Boulder Mine. The reasons for this assumption are described in the introduction to Chapter Four. The only way to provide "factual" data, as requested by this commentor, would be to initiate mining and tailing disposal. |
| 15-39 | See the responses to comments 15-23 and 15-25 regarding an exemption or variance from the nondegradation rules. Department of State Lands intends that if the mine is permitted it fully comply with the Montana Metal Mine Reclamation Act. |
| 15-40 | Surface water discharge may be permitted based upon a degree of treatment (for instance, 95 percent removal of a particular compound) depending on the decisions reached by the Board of Health and Environmental Sciences. |
| 15-41 | The agencies note the commentors preference for Alternative 6A. See the responses to earlier comments, including 15-23, 15-25, and 15-29 regarding nondegradation rules and exemptions, and compliance with MMRA. |
| **Gutkoski - Madison Gallatin Alliance - August 2, 1991** | |
| 16-1 | See response to comment 9-1. SPGMR would be required to abide by the mitigation measures outlined in the Jackpine Environmental Assessment Decision Notice, as amended (Appendix B) which include daily removal of roadside carrion along the East Boulder Road to prevent mortality to bald eagles during the winter season. The Jackpine EA mitigation measures have been restated for clarity in Section 2.5.12.1 of the final EIS along with the mitigation measures developed by the agencies in response to the proposed action. (See also the conservation measures outlined in the Biological Assessment, Appendix D). |
| 16-2 | See responses to comments 1-12, 9-2, and 11-4. |
| 16-3 | See response to comment 12-12. |

| Letter and Comment Number | Response |
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| 16-4 | The commentor's position with respect to a potential modification to the existing water quality is noted. As noted in earlier comment responses (see 15-23 and 15-25) Department of State Lands and the Department of Health and Environmental Sciences would not consider a waiver to be a violation of state law, since in no instance would granting of a petition authorize water quality standards to be violated. The nondegradation rules were developed in anticipation of certain instances where degradation could not be prevented. The Board of Health and Environmental Sciences will make the determination as to whether SPGMR receives modification of ambient water quality and to what degree degradation of the East Boulder River would be allowed. |
| 16-5 | The mitigations and monitoring requirements described in Alternative 7, and also incorporated in Alternative 8, are not merely "suggestions." If either of these alternatives are selected for implementation SPGMR would be required by law and regulation to abide by the stipulated requirements. The monitoring programs typically outline the purpose, goals and standards to be met. Specifications for how to meet those goals and standards are left to SPGMR to develop, but the plans must be reviewed and approved by the agencies prior to implementation. As an example, see the objectives SPGMR would have to meet for wildlife monitoring in Section 2.5.12.2, and for water quality monitoring in Section 2.5.5.<br><br>See responses to comments 10-23 and 14-24 regarding establishment of the mining bond. |

| Letter and Comment Number | Response |
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**Souvigney - Greater Yellowstone Coalition - October 8, 1991**

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| 17-1 | Additional information has been added to Section 2.4.4 which provides more detail regarding water treatment alternatives, including the potential for hazardous waste generation, and treatment effectiveness. Sections 4.2 and 4.3 have been revised, using a larger water quality database, to more fully evaluate impacts on surface waters and groundwater. Also, please see responses to comments 9-5, 10-11, 12-5, and 14-3 regarding these issues, water production from the mine, and acid-generation potential. |
| 17-2 | As this comment points out, pre-mining estimates and assumptions do not always hold up during project implementation. However, short of implementation, there is often no way to know exactly what environmental impacts would occur. Hence, the requirement for monitoring and contingency plans for those resources (such as wildlife and water quality), which are less predictable. Pre-mine estimates of contaminant migration at the Blue Range mine were inaccurate, but the monitoring stipulation worked as planned by providing an early indication of a groundwater quality problem. This prevented any impacts to the drinking water aquifer or residential water supplies. |
| 17-3 | All of the alternatives (except Alternatives 1 and 2) evaluated in this EIS were developed by the agencies. The water treatment alternatives were developed so as to provide the Board of Health and Environmental Sciences with an indication of the technologies which could be used to reduce or prevent water degradation in the East Boulder River. The agencies will issue a Record of Decision based primarily on this EIS and, in part, on the Board's decision regarding SPGMR's petition. |
| 17-4 | Comment noted. |
| 17-5 | See response to comment 10-7. |
| 17-6 | See responses to comments 3-4, 3-5, 9-2, and 11-4. |
| 17-7 | See responses to comments 12-12 and 14-29. |
| 17-8 | Several sites were considered in the Jackpine EA and by SPGMR during early feasibility studies. A site in Dry Fork was studied but rejected because of geotechnical reasons (highly fluctuating groundwater table) and wildlife concerns. The proposed site contains storage for about 27 years of operation, with peak production reaching 2,000 tons per day. Increasing production above 2,000 tons per day is highly unlikely with current technology because of several factors including the width of the vein and the long haulage distance to the surface. Requests in the future for other tailing sites would have to undergo separate NEPA/MEPA analysis. |

| Letter and Comment Number | Response |
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| 17-9 | As mentioned above in response to comment 17-8, it is very highly unlikely that there is a potential for expansion at this site because of the narrow configuration of the vein, the long haulage distance to the surface, and the fact that cut-and-fill mining methods in this type of ore is very labor intensive. The agencies feel that 2,000 tons per day is the maximum production rate expected at this site with current technology because of the limiting factors mentioned above. The proposed site has a capacity of about 27 years for tailing disposal with a peak production of 2,000 tons per day. |
| 17-10 | The Metal Mine Reclamation Act requires a review of reclamation and bonding as needed, therefore, it is not necessary to include a bond-review stipulation in the permit. Permit conditions are adopted only to clarify or modify a plan or to supplement the Act, where authority exists. Permit conditions are not intended to be redundant. Similarly, the Act provides authority for permit reviews as needed. It is therefore not necessary to include a permit review stipulation either.<br><br>See responses to comments 10-17 and 10-23. Revegetation success or failure would be monitored by the agencies to the point of bond release. The determination of successful revegetation is a judgement to be made by the agencies. The agencies look for erosion control, revegetation success (comparable utility and stability), and chemical stability of mine waste products (e.g. acid mine drainage). |
| 17-11 | The goals and criteria for minimum acceptance for the reclamation of metal mines are defined in Montana's Metal Mine Reclamation Act (Title 82, Chapter 4, Reclamation, Part 3 - Metal Mine Reclamation). The Act requires reclamation which may or may not be to the extent considered "restoration" by the commentor. Also, see response to comment 10-17.<br><br>SPGMR is committed to dewatering the impounded tailing to the extent closure and reclamation procedures are approved by the agencies. Dewatering methods are discussed in Chapter Four of the Plan of Operations (SPGMR 1990, as amended) and in Section 2.3.20.7 of the EIS. The agencies have added requirements for tailing impoundment reclamation in Section 2.5.6.1 of the EIS.<br><br>Geotechnical testing for impoundment stability would be required. SPGMR would be required to maintain an effective surface water diversion around the tailing impoundment in perpetuity.<br><br>It should be noted that the agencies intentionally describe activities which might occur in the future, by "could" or "would," rather than "will." This is considered proper grammer. The reason for this grammatical logic is that the permitting decisions have not been made, and requirements stipulated in the different alternatives are dependant on the selection of that alternative in the Record of Decision. Thus, an action "would" occur, if permitted. |
| 17-12 | See response to comment 9-4. |

| Letter and Comment Number | Response |
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| 17-13 | The location of the East Boulder Mine is much more protected from exposure, particularly winter wind. The Stillwater Mine is located in a major canyon where frequent winds are common year round and most severe to vegetation during winter. The wind tunnel effect has hindered the progress of tree reestablishment.<br><br>See also response to comment 14-27. |
| 17-14 | Comment noted. The legacy of abandoned mines is one of no reclamation laws and no bonding mechanisms to assure legal compliance or post-mining cleanup. However, in today's regulatory framework are multiple statutes and technologies which exist to maximize future productivity and minimize potential impact. If any activities are conducted in perpetuity they would be funded by the applicant through the bonding process, <u>not</u> citizens and taxpayers. |
| 17-15 | The GNF has reevaluated the HEI and has considered alternatives to achieve an HEI closer to the Forest standard. See the expanded discussion regarding HEI in Section 4.6.2. |
| 17-16 | See response to comment 14-33. |
| 17-17 | The tailing impoundment would be fenced. See response to comment 14-34. |
| 17-18 | See response to comment 16-1. |
| 17-19 | See mitigation measures identified in Section 2.5.12.1 and conservation measures identified in the Biological Assessment. |
| 17-20 | An employee education program regarding protection of threatened and endangered species is included as a mitigation measure in the Jackpine Environmental Assessment Decision Notice. Wildlife mitigation measures from the Jackpine EA were incorporated by reference in Alternative 7 in the draft EIS, but have been restated for clarity in the final EIS (Section 2.5.12.1). (See also conservation measures in the Biological Assessment). |
| 17-21 | There is not a discrepancy between the quoted survey results; they were two different studies which surveyed two different populations. One was a survey of local residents of Big Timber, the other surveyed a very specific population of mostly male miners. The results of these surveys were given to establish what could be considered the minimum and maximum rates of participation in these recreation activities. The agencies agree that more research on the recreational use patterns of mine workers and their families would be helpful in evaluating impacts of a project of this nature, therefore a monitoring requirement has been added in the final EIS requiring SPGMR to fund a creel survey to measure change in fishing pressure and conduct annual surveys of employees regarding recreational use patterns (see also response and comment 6-1 and revised text in Sections 2.5.12.2 and 2.5.9). |

| Letter and Comment Number | Response |
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| 17-22 | SPGMR would implement an employee environmental education program (see Appendix D, Biological Assessment). |
| 17-23 | The impact of increased traffic on the East Boulder road to residents along that road is acknowledged in the EIS. SPGMR has committed to establishing a bussing plan (see response to comment 9-1) which would reduce traffic impacts. Delivery of supplies and materials would be limited to daylight hours. |
| 17-24 | See response to comment 9-1. |
| 17-25 | Under the MEPA process, the draft EIS and final EIS constitute the formal response to your concerns and comments as well as the comments of others. Your questions and concerns are appropriately addressed here and in the text of the EIS.<br><br>With the implementation of a bussing program, the size of the parking lot can be reduced substantially to provide room for approximately 85 cars. Approximately 1.5 acre would be required at the mine facilities for parking space. Also see response to comment 9-1. |
| 17-26 | A discussion of materials used in the milling process which may be considered hazardous is contained in Section 2.3.3.2. SPGMR has committed (in Section 2.3.16) to properly dispose of any wastes classified as hazardous. With respect to transportation of potentially hazardous materials, a mitigation included in Alternative 7 (Section 2.5.16) requires that an emergency response plan be developed which outlines measures to be taken in the event of spills or leaks of hazardous substances and other situations. |
| 17-27 | See additional clarification in Section 4.14.2.5. |
| 17-28 | See response to comment 10-24. |

| Letter and Comment Number | Response |
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| 17-29 | Discussion of the potential socioeconomic effects of temporary or permanent closure of the mine or a reduction in the workforce is provided in Section 4.14.2.10. A shutdown of the mine would result in the loss of up to 600 high paying mining jobs and the associated induced jobs in Sweet Grass County as well as Livingston and Columbus. Extended lay-offs or closure would result in out-migration of population, which would probably be somewhat less than the projected 1,196 total in-migrant population associated with the project. Population out-migration (absent population growth resulting from other sources) would result in a decreased demand for housing and local government facilities and services. Decreases in local government sales and property taxes would occur.<br><br>The provisions of the Montana Hard Rock Mining Impact Act and the Montana Property Tax Base Sharing Act require the project developer to identify and commit to pay for (through property tax prepayments, grants or education impact bonds) all increases in capital and net operating costs. Additionally, a trust grant-loan program exists which would provide funds to local governments and schools to address economic and fiscal impacts and for economic development. If these statutory safeguards are followed, negative impacts of premature closure or a 50 percent reduction in workforce are likely to be minimal. A Hard Rock Impact Plan is being developed by County representatives and SPGMR which identifies responsibilities and funding requirements.<br><br>Mine closure would have negative effects on the Sweet Grass County economy. However, given the history of both the East Boulder and the Stillwater projects, it is likely that local businesses would be cautious in expanding to accommodate project related growth.<br><br>Substantial, long term layoffs and mine closure would result in negative socioeconomic impacts to individuals and families and to the social structure of the community. |
| **Gilbert - Stillwater PGM Resources - October 1, 1991** | |
| 18-1 | The agencies agree this information should be pointed out to the public. The text has been revised accordingly in the final EIS. |
| 18-2 | The agencies considered the proposed language and have incorporated it into the final EIS with modifications (see Section 2.5.1). |
| 18-3 | If the percolation pond is the chosen method for long-term treatment of mine drainage, SPGMR would be required to maintain the pond until the water met background conditions or standards determined by the Board of Health. Once the water is sufficiently "clean" reversion of the pond to a wetland may be an option, rather than a diversion to the river. The agencies are willing to work with SPGMR on this option and have included this option in Section 2.5.1. However, as noted in response to comment 15-5, the agencies will not consider the creation of artificial wetlands for use in treating mine discharge water during operations. |

| Letter and Comment Number | Response |
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| 18-4 | The agencies considered the proposed language and have incorporated it into the final EIS (see Section 2.5.1). |
| 18-5 | The requested change has been made (see Section 2.5.2). |
| 18-6 | The agencies appreciate the commentor's awareness of the State Agency's interest in monitoring septic systems in particular and compliance monitoring in general. However, the requirement for monitoring highest risk areas has not been deleted. If the mine is permitted it will be up to the mine company to develop a monitoring plan which meets the requirements of Section 2.5.3 and the water quality monitoring plan in Section 2.5.5 |
| 18-7 | The agencies developed the alternative tailing impoundment configuration (2:1 slope) to address concerns with stability, visual impact, and reclamation associated with the proposed 1.6:1 slope. Impacts from both alternatives were analyzed in the EIS. With regard to SPGMR's specific concerns: |

1) Agree. The capacity of the tailing impoundment would be reduced.

2) Agree, more waste rock would be required. Some additional waste rock would be produced if twin adits are driven (Alternative 8). If additional material is required, a borrow source may have to be identified.

3) Another environmental analysis would be required if SPGMR proposed to construct another tailing impoundment, and may be necessary if waste rock is to be obtained from an outside borrow area. The agencies do not understand SPGMR's assertion that the additional tailing impoundment would be required "3-5 years earlier than necessary." As noted in comment 1) above, the impoundment capacity would be reduced by 2-3 years. Also, SPGMR's assertion implies that they believe another impoundment will be required regardless of the slope angle. The Company should provide their information and plans regarding future expansions to DSL and GNF immediately if such is the case.

4) Agree that SPGMR would incur additional costs. Since SPGMR's economic projections for the mine are held confidential an independent evaluation of the impact on profitability cannot be made. Again, plans for future expansions should be brought forward and disclosed in this analysis.

5) Disagree. See Section 4.12.3.

6) Habitat loss is not a factor in the agencies preference for the 2:1 slope.

| Letter and Comment Number | Response |
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7) The difference in stability is not negligible; the 2:1 slope is estimated to be approximately 12 percent more stable than the 1.6:1 slope. The agencies are concerned with potential impacts to the environment as well as the public.

8) The agencies believe that the slope angle would increase the potential for reclamation success. Given the lack of proven reclamation for any large tailing impoundments it would be hard to demonstrate the difference in reclamation potential between the proposals.

The environmental consequences of using a 2:1 impoundment slope have been considered in Chapter Four of the EIS, and compared against the Company's proposed 1.6:1 slope in Chapter Five. As discussed above, a complete economic evaluation is not possible unless SPGMR chooses to provide baseline economic data and operating and profit forecasts for the analysis. The agencies have recognized that the 2:1 slope would be more costly, and reduce the mine operating life.

The agencies do not agree that the 2:1 slope is a final reclamation angle. On-going construction would have to be at approximately the 2:1 angle because reclamation would be on-going.

The agencies appreciate SPGMR's perspective, but the agencies have, in accordance with MEPA and NEPA, relied on independent analysis and public input as well as SPGMR's information to evaluate this project and alternatives. Final decisions concerning this proposal will be based on the environmental impact analysis: emotions and precedent-setting value are not yet factors in the decision process.

18-8 The agencies considered the proposed language and have incorporated it into the final EIS (see Section 2.5.7).

18-9 The agencies considered the proposed language and have incorporated it into the final EIS (see Section 2.5.7).

18-10 The agencies considered the proposed language and have incorporated it with modifications (see Section 2.5.7).

18-11 The agencies have reconsidered the requirements for dust suppressant applications on roads. SPGMR would use only chemical compounds approved by the Forest Service which are applied by a licensed, bonded applier. The road mitigation concerning application of dust retardants (Section 2.5.7) has been modified to eliminate the requirement for a risk analysis.

18-12 Your comment is noted; however, the wording in the draft EIS will remain unchanged. The plan must address steps to be taken if acid-forming rock is encountered.

| Letter and Comment Number | Response |
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| 18-13 | All suitable soils would be salvaged from areas to be disturbed. Suitable soils are those which are composed of 50 percent or less coarse fragments and one percent or more organic matter as defined by the DSL. These soils would be salvaged regardless of the difficulty posed by the size of the coarse fragment component.<br><br>Should reclamation be required for the 1.6(H):1(V) slope, additional measures such as netting would be required during initial reclamation efforts to improve chances for successful reclamation. |
| 18-14 | The agencies considered the proposed language and have incorporated it into the final EIS (see Section 2.5.11). |
| 18-15 | The agencies considered the proposed language and have incorporated it with modification (see Section 2.5.12.1). |
| 18-16 | The mitigation has been clarified in the text. |
| 18-17 | The agencies considered the proposed language and have incorporated it into the final EIS (see Section 2.5.15). |
| 18-18 | Surveys which have been conducted on the East Boulder Plateau have not been specific to locations where breakouts may occur, and in fact some of the surveys are not detailed (cultural resources) or have not been done (wetlands analysis). The agencies believe these surveys are warranted and necessary. |
| 18-19 | Acronyms are spelled out at the beginning of each chapter. "Gallatin National Forest" (GNF) is spelled out in the introduction to Chapter Two. |
| 18-20 | The orphaned section has been corrected. |
| 18-21 | Spelling of "except" has been corrected. |
| 18-22 | Spelling of "Sciences" has been corrected. |
| 18-23 | Spelling of "stoping" has been corrected. |
| 18-24 | Spacing error has been corrected. |
| 18-25 | Spelling of "slurrying" has been corrected. |
| 18-26 | Spelling of "approximately" has been corrected. |
| 18-27 | The year in the citation has been corrected. |
| 18-28 | Meters has been used consistently throughout. |
| 18-29 | Spacing error has been corrected. |
| 18-30 | Spelling of "a" has been corrected. |
| 18-31 | Spelling of "Service" has been corrected. |

| Letter and Comment Number | Response |
|---|---|
| 18-32 | Spelling of "Goosey" has been corrected. |
| 18-33 | Spelling of "meet" has been corrected. |
| 18-34 | Spelling of "stopes" has been corrected. |
| 18-35 | Spelling of "stoping" has been corrected. |
| 18-36 | Spelling of "bridge" has been corrected. |
| 18-37 | Spacing error has been corrected. |
| 18-38 | Spacing error has been corrected. |
| 18-39 | Spelling of "Livingston" has been corrected. |
| 18-40 | Spelling of "bench" has been corrected. |
| 18-41 | Spelling of "affect" has been corrected. |
| 18-42 | Spelling of "affect" has been corrected. |
| 18-43 | Reference should read "4.14.2.10". The text has been corrected. |
| 18-44 | Reference should read "4.14.2.10". The text has been corrected. |
| **Mason - Hydrometrics, Inc. - June 7, 1991** | |
| 19-1 | The text has been corrected to indicate that iron would not exceed water quality standards. Direct surface water discharge is discussed in Section 4.2.2. |
| 19-2 | According to projections developed in Section 4.2, there would be a small but detectable increase in total nitrogen in the East Boulder River if Alternative 6A were implemented. The text in Section 2.4.4.1 has been changed to reflect this estimate. |
| 19-3 | Bench tests would be more direct and useful, but probably insufficient as well. A partitioning calculation would still likely be needed. The most direct and reliable method for studying different flocculents would be to set up a demonstration test using mine discharge flows. |
| 19-4 | The reference to Alternative 7 has been corrected. |
| 19-5 | The flow range has been corrected. |
| 19-6 | The text has been changed to reflect that floodplain delineation was performed using values generated by the 1/2 PMF. |
| 19-7 | The label has been corrected. |
| 19-8 | The label has been corrected. |

| Letter and Comment Number | Response |
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| 19-9 | The information from the monitoring well and the water supply well has been reviewed and included in the final EIS. |
| 19-10 | The reference to the 100 year floodplain has been changed. |
| 19-11 | Agree, see Section 4.2.2 (Operations). |
| 19-12 | Paragraph 7 has been changed to clarify the statement.<br><br>Streamflows may increase if the hydraulic head from percolation in the groundwater is greater than the hydraulic head at the stream. |
| 19-13 | See response to comment 19-1. |
| 19-14 | Agree, see Section 2.5.3. |
| 19-15 | The results of a single pump test on a single well in the "deep alluvial aquifer" should be interpreted with a great deal of care. Although the agencies would not rely on the aquifer testing information supplied by the company, they do agree that the groundwater appropriations would probably not impact streamflow. However, more information regarding the groundwater system is desirable for confirmation. |
| 19-16 | The statement on page 4-9 paragraph 1 reads (completely) "Since these are low flow conditions this increase will not impact channel morphology". This discussion refers to potential impacts at low flow conditions. Since flows increase from this point (i.e., low flow) the additional flow will not impact the channel morphology.<br><br>The statement on page 4-16 paragraph 3 reflects conditions after closure of the mine. The flow into the percolation ponds and hence into the East Boulder River would occur during all flow conditions (except when the river is under losing stream conditions). |
| 19-17 | It is agreed that the morphological characteristics of the stream are the result of the topography and geology of the area. However, not all downstream sections of the East Boulder River are steep. Some areas (particularly near tributary inflows) have a relatively gentle grade. It is these areas where sediment is likely to accumulate during non-high flow events. The increased flows may scour, and re-suspend these sediments further downstream. |
| 19-18 | It is agreed that "low" quality water is not anticipated from the mine. Mine discharge is generally above (better than) stream standards. However, concentrations of some water quality variables (nitrates, total cadmium, total zinc, and total lead) are likely to be higher (worse) than ambient conditions in the East Boulder River. |
| 19-19 | Correct. The text in Section 4.2 has been modified to reflect this. |

| Letter and Comment Number | Response |
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| 19-20 | The comment refers to discussions under two different scenarios. The statement on page 4-16 refers to conditions after mine closure when, it is assumed, it would not be necessary to pump out of the water supply well. |
| 19-21 | Reference to Alternative 7 has been corrected. |

**Deegan - June 16, 1991**

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| 20-1 | Your opinion is noted. The EIS contains alternatives and mitigations which were developed because of potential environmental impacts and concerns expressed during the public scoping process. |

**Broughton - Received July 23, 1991**

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| 21-1 | Property values are affected by supply and demand conditions and the amenities and disseminates associated with the intended use of the particular property under consideration. The increase in traffic on road SG 31 would constitute an inconvenience for residential properties adjacent to the road. This could, in turn, affect demand for those properties from certain segments of the market. There may be some increase in demand for residential properties near the proposed project stemming from project workers who desire to live close to the project. For those residential properties that mine workers are able to afford, the increased demand may offset property value effects associated with the inconvenience resulting from increased traffic.<br><br>For larger parcels in residential use or with an ancillary residential use, the increased traffic could negatively affect property values. |

| Letter and Comment Number | Response |
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**Stoltz - July 31, 1991**

22-1 See response to comment 16-4.

22-2 Comment regarding tailing impoundment noted. Some dewatering of the tailing impoundment would occur during operations, and to the extent possible when the mine is closed (See response to comment 12-12). Liquid would be recycled into the ore processing system.

For information regarding reclamation and bonding, see responses to comments 10-17 and 10-23. Note the last statement of the first paragraph of that response says "The subsequent use of the disturbed lands must be of comparable utility and stability as that of adjacent land," this does not necessarily mean a return to pre-mine conditions.

22-3 Response to comment 13-1.

22-4 The agencies will enforce all mitigation measures required in the chosen alternative. All data provided by the company will be verified by the agencies and agency personnel will make periodic, announced and unannounced visits to the mine site to ensure compliance.

22-5 See response to comment 14-33.

22-6 See response to comment 9-1.

**W. Bowman, V. Bowman - Received August 1, 1991**

23-1 See response to comment 16-4, 15-23, 15-25.

23-2 See Section 2.5 for water quality monitoring.

23-3 See response to comment 10-24.

23-4 See response to comment 14-33.

23-5 There are mitigation measures requiring SPGMR to develop plans for pond maintenance and for channeling surface water runoff away from the tailing impoundment, see Sections 2.5.1 and 2.5.2. Regarding a review of bonding levels and reclamation requirements, see the information provided in response to comment 17-10, 10-17, 10-23.

23-6 See responses to comments 9-4 and 18-13.

| Letter and Comment Number | Response |
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**D. Anstett, A. Anstett - August 2, 1991**

24-1 Additional information has been added to the final EIS which should alleviate much of the concern over lack of detail. More information is included on water treatment alternatives in Section 2.4.4, including example designs of common wastewater treatment facilities. However, a site-specific design cannot be developed without data which can only be obtained after exploration has begun. Also, see responses to comments 9-4, 10-9, 10-11, 10-12 and 11-1.

For information regarding the weed control program, see response to comment 10-19. Regarding air pollution control, see Appendix C - Preliminary Determination on Air Quality Permit Application. Regarding reclamation, SPGMR has proposed a reclamation plan summarized in Section 2.3.20. The agencies have reviewed this plan and added some mitigation measures requiring changes or additions to SPGMR's proposed reclamation plan in Alternative 7, see Section 2.5.6.2. See response to comment
9-4 regarding available soil for reclamation. Goals and standards for a water monitoring program have been developed and are included in the final EIS in Section 2.5.5. A bussing program has been incorporated into the proposed action; refer to Section 2.3.18.

24-2 The agencies believe that sufficient safeguards have been incorporated into the final EIS, particularly the preferred alternatives and mitigations included in Section 2.5, to assure that unacceptable impacts to the environment would not occur. This final EIS contains considerably more specific information regarding some resources, particularly water and reclamation requirements, which were deemed too vague by many commentors. However, some information cannot be quantified prior to mine exploration. For example, a specific design of a wastewater treatment system is not possible without exact information on such parameters as flow rate, water quality, etc.

For post-permit changes, DSL and GNF would review new mine information or requests from SPGMR for modifications to the permit to determine environmental impacts. Decisions on such matters are open to public review, and depending on the significance of the information or modification, public comment may be solicited prior to decision making as well. Some decisions are left to agency discretion, however that information is available to the public.

24-3 See response to comment 16-4, 15-23, 15-25.

24-4 See comment and response 8-1 clarifying this issue.

24-5 See Section 2.5.5. of the final EIS.

| Letter and Comment Number | Response |
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| 24-6 | See response to comment 10-24 regarding time restrictions.<br><br>Section 26.4.108 of the rules implementing the Metal Mine Reclamation Act addresses the issue of temporary closures. The final reclamation bond cannot be used in the case of temporary shutdown. However, if the mine is determined to be "abandoned," the reclamation required at the particular stage of mine development would be sufficient. (An operation is presumed to be "abandoned or completed as soon as ore ceases to be extracted for future use or processing, although the permittee can rebut this presumption based on such situations as worker strikes or operations seasonality.) |
| 24-7 | See response to comment 10-9. |
| 24-8 | See response to comment 9-1. |
| **Blake - August 4, 1991** | |
| 25-1 | Comment 24-1 is very similar to this comment; see the response to comment 24-1.<br><br>Regarding impacts to wildlife, refer to Sections 2.5.12 and 4.6. of the EIS. |
| 25-2 | See response to comment 24-2. |
| **McNamee - August 11, 1991** | |
| 26-1 | SPGMR would be limited by permit requirements as to the magnitude and extent of impact the mine operations may have on the terrestrial environment. Most areas should be reclaimable to the stated goal of pre-mine condition. However, the tailing impoundment would not be restored to the natural, pre-mining condition. |
| 26-2 | The agencies will conduct periodic inspections to ensure mitigation measures, including monitoring, are being implemented as required prior to bond release. |
| 26-3 | See response to comment 9-1. |
| 26-4 | See response to comment 10-24. |
| 26-5 | See responses to comments 14-33 and 16-1. |
| 26-6 | See Section 2.5.1 in the EIS for a discussion on mine drainage. |
| 26-7 | See response to comment 9-4. |
| 26-8 | See response to comment 15-29. |
| **Smith - August 29, 1991** | |
| 27-1 | See response to comment 9-1. |
| 27-2 | See response to comment 16-4. |
| **Smith - October 11, 1991** | |

| Letter and Comment Number | Response |
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| 28-1 | See response to comment 16-4. |
| 28-2 | Your comment is noted. |
| **McMullen - August 31, 1991** | |
| 29-1 | See response to comment 16-4 regarding a modification to existing water quality. |
| 29-2 | A water monitoring plan is required which meets the goals and standards shown in Section 2.5.5. |
| 29-3 | See responses to comments 10-23, 14-24, and 14-36 regarding bonding requirements. |
| 29-4 | Refer to Section 2.5.11 which requires mitigation measures in regards to impoundment stability, and Section 2.5.3 which requires monitoring of tailing impoundment water and outlines steps to be taken degradation of groundwater occurs due to leaks. These mitigation measures would be required if Alternatives 7 or 8 are chosen. Also see response to comment 12-10. |
| 29-5 | See response to comment 9-1. |
| 29-6 | See response to comment 12-11. |
| 29-7 | See responses to comments 9-4. |
| 29-8 | See response to comment 24-1. |
| 29-9 | One of the purposes of the National Environmental Policy Act, as amended, is "... to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man..." In this EIS, impacts to man, wildlife, and other resources resulting from the proposed mine, have been analyzed and measures to reduce or eliminate impacts have been identified (refer to Section 2.5) |
| **McMullen - October 6, 1991** | |
| 30-1 | See response to comment 13-3 regarding alternatives development and NEPA requirements. A range of alternatives that do not allow degradation of surface water or groundwater is not technologically feasible. The alternatives do include the demonstrated best available technology for nitrate reduction in drinking water, although even the use of reverse osmosis for discharge water treatment could result in some water degradation. |

| Letter and Comment Number | Response |
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| 30-2 | It is an assumption that mine water discharge, waste rock composition, and other features or results of the East Boulder project would be very similar to the Stillwater Mine. However, this is an assumption which is based on extensive information regarding the Stillwater Geologic Complex and the ore to be mined from the Complex. The minerals to be mined from the East Boulder project are from the same ore zone as the Stillwater Mine ores; waste rock and tailing properties should therefore be very similar. Mine water quality should be similar as well since the same blasting processes and compounds will be used. In fact, the large similarity with the Stillwater Mine allows the assumptions in the EIS to be made with a great deal more confidence than would occur for another precious metal mine project for which there were no analog. For more information regarding the similarities between the Stillwater Mine and the proposed East Boulder project, see the beginning of Chapter Four. |
| 30-3 | As noted in previous comments (9-5, 10-9, 10-11, 10-12, and 11-1) it is not reasonable to create a specific design for a water treatment facility without the required process engineering information. An example design system has been included in Section 2.4.4. If a treatment system is used it would be designed to handle expected influent (the mine discharge water) as well as any contingency waters. These may include pumpback waters from a malfunctioning septic field or other sources. |
| 30-4 | SPGMR would be required to submit a water monitoring plan under either Alternative 7 or 8. This monitoring plan would meet the goals and standards described in Section 2.5.5 and would address the concerns brought up in your comment. |
| 30-5 | There would be wells installed at the downgradient perimeter of the East Boulder Mine operations area for the purpose of monitoring groundwater quality. Fuel tanks and fuel loading areas would be bermed to physically contain petroleum spills from migrating over the land surface. The reagent loading, storage, and mixing areas would have physical containment as well to prevent surface migration of spills or leaks. |
| 30-6 | See response to comment 12-5. |
| 30-7 | See Section 2.5.2. See response to comment 30-5 regarding spill containment. |
| 30-8 | See Section 2.5.6.1 regarding tailing impoundment reclamation. The mitigation measures outlined in this section would be required if Alternative 7 or 8 is chosen. See Section 2.4.1.3 for a discussion on an alternative with a more gradual 3(H):1(V) slope and the reasons it was not considered further. |
| 30-9 | The U.S. EPA has recently (1990) promulgated regulations that will require various industries to begin surface water management plans for stormwater runoff. The mining industry is one of those industries. The regulations require that any stormwater coming in contact with overburden or raw material must be treated by best available technology (BAT). See Section 2.5.2.<br><br>See response to comment 14-34 regarding a fence around the tailing impoundment. |

| Letter and Comment Number | Response |
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| 30-10 | The tailing impoundment is not expected to overflow. Several design and operating conditions would help to provide this assurance: First, evaporation exceeds precipitation, which means there is a net loss of liquid from the impoundment to the atmosphere. Second, in accordance with standard engineering and construction practices, the tailing pond is "over" designed, meaning it can hold more liquid than is expected to be within it. Also, upgradient water would be diverted around the impoundment to prevent additional inflow. Finally, a containment ditch would be constructed around the impoundment to hold water which spilled over in the event capacity were exceeded. A contingency plan would be required under Alternatives 7 and 8 in the event of a tailing dam failure. |
| 30-11 | See response to comment 10-9 regarding the use of a double-lined leak prevention system. The agencies believe a single liner is adequate based on the anticipated tailing chemistry. However, a modification to the proposed tailing impoundment design has been added to Section 2.5.3 which requires that the impoundment be sloped so that liquid or leachate can be collected and monitored for quantity and quality. If DSL or GNF believe the impoundment water quality is sufficiently poor that degradation of groundwater would occur if the liner leaks, the liquid would be pumped from the collection area to a treatment system or recycled in the mining/milling process. |
| 30-12 | See response to comment 12-10. |
| 30-13 | See responses to comments 1-1 and 10-19. See Section 2.3.20.9 regarding SPGMR's proposed dust control plan. |
| 30-14 | See Section 1.4 in the final EIS. |
| 30-15 | The estimate of fourteen years of post-mining water treatment was developed by SPGMR's consultant for the sole purpose of estimating treatment costs. However, should treatment be required, it would continue until concentrations of all compounds in the mine discharge water reach levels deemed acceptable by the Water Quality Act and the Board of Health and Environmental Sciences. It is anticipated that mine discharge water would improve after blasting and mining operations cease, until natural background quality is reached. |
| 30-16 | The estimated bond requirement is approximately $3.5 million. |
| 30-17 | See response to comment 16-4. |
| 30-18 | See response to comment 9-1. |
| **S. Glidden - September 4, 1991** | |
| 31-1 | See response to comment 16-4. |
| 31-2 | See Section 2.5.3 and 2.5.11 in the EIS. |
| 31-3 | See response to comment 11-4. |

| Letter and Comment Number | Response |
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| 31-4 | See response to comment 12-12. |
| 31-5 | See responses to comments 10-23 and 14-24. |
| 31-6 | See response to comment 9-4. |
| 31-7 | See response to comment 10-24. |
| 31-8 | See response to comment 9-1. |
| 31-9 | See responses to comments 14-33 and 16-1. |
| **R. Glidden - September 5, 1991** | |
| 32-1 | See response to comment 16-4. |
| 32-2 | See responses to comments 3-4, 3-5, and 11-4. |
| 32-3 | See responses to comments 12-12 and 10-17. |
| 32-4 | See response to comment 10-24. |
| **Hjortsberg - September 5, 1991** | |
| 33-1 | See response to comment 16-4. |
| 33-2 | See responses to comments 8-1 and 14-2. |
| 33-3 | See response to comment 9-1. |
| 33-4 | See responses to comments 10-9, 12-10, and 30-11. Also, the tailing pond would be approximately 600 to 700 feet from the river. The outside toe of the tailing dam would be approximately 300 to 400 feet from the river. |
| 33-5 | See response to comment 11-4. |
| 33-6 | See response to comment 9-4. |

| Letter and Comment Number | Response |
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**Gano - September 13, 1991**

34-1 SPGMR would be required to monitor air and water quality conditions subject to periodic field checks and reviews of data by the agencies until bond release. Inspection reports and monitoring data are available to the public for review.

34-2 See responses to comments 34-1 and 16-4.

34-3 Unfortunately, it has been proven that for a minority of businesses faced with environmental regulation, it is necessary to have penalties which are more costly than the price required for compliance. Montana law and Federal law provide for costly penalties to non-compliant mine operators.

**Ehley - October 9, 1991**

35-1 The Board of Health and Environmental Sciences will decide on SPGMR's nondegradation petition. Water monitoring would occur throughout the life of the mine to ensure required limits are not exceeded.

35-2 Early detection through monitoring would prevent contamination of groundwater.

35-3 The 1872 Mining Law provides the right to claim the benefits of mineral extraction and processing. Montana's nondegradation law measures would be implemented to prevent or limit degradation of the river.

**Pauli - October 10, 1991**

36-1 See response to comment 16-4.

36-2 This decision will be made by the Board of Health and Environmental Sciences.

36-3 If Alternative 7 or 8 is chosen, mitigation measures and /or monitoring plans would be implemented to help resolve many of the concerns you listed.

**Gingras - October 10, 1991**

37-1 The tailing dam slope noted for Alternative 7 in Table 2.1-1 was an error. It should have read "2:1." The table has been revised in the final EIS. In this final EIS the agencies have identified the 2:1 slope as their preferred alternative.

| Letter and Comment Number | Response |
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| 37-2 | The agencies have not studied alternative production limits, and do not believe it is appropriate to do so unless limiting production would minimize or alleviate an environmental impact which could not otherwise be mitigated. It should be noted that total production may be limited, though, as an effect of changing the tailing impoundment dam slope from 1.6:1 to 2:1. This would reduce the capacity of the impoundment and production by approximately 10 percent.<br><br>Also, see responses to comments 17-8 and 17-9 which explain why the agencies believe production would not be increased. |
| 37-3 | SPGMR would be required to notify the agencies of any changes in reagents or concentrations employed in the milling process. The agencies would monitor the uses of mill process reagents for the life of the mill operations. This stipulation has been added to Section 2.5.19. |
| 37-4 | Recycling of tailing impoundment water through the ore processing system should not increase concentrations of reagents. The reagent concentrations in process water are optimized; in other words, kept at the concentration which results in the most efficient frothing, collecting, or other procedure. If tailing water has reagents in it when recycled this would just result in a lesser amount of reagent added during the processing of ore. |
| 37-5 | The agencies would inspect/monitor the placement of the tailing impoundment liner. See response to comment 10-9. |
| 37-6 | SPGMR expects to use most of the waste rock in construction of the tailing impoundment and dam and other surface facilities, although some may be used for underground construction. The final dam volume for the proposed 1.6:1 slope is estimated to require 3.63 million cubic yards of waste rock (4.1 million cubic yards for the alternative 2:1 slope), while the total estimated waste rock produced from the mine is only 3.86 million cubic yards. Although there are likely to be temporary surpluses of waste rock which require storage, there is more likely to be a shortage of waste rock during the latter stages of mine life. See also response to comment 3.7. |
| 37-7 | The volume of waste rock to be disposed in the waste dump facility constructed during the exploration phase of the Frog Pond adit is expected to be minimal (See Section 2.3.12.4 of the EIS). Only the waste rock produced from the initial development of the Frog Pond facility, the 9250 adit, and the 9450 adit would be placed on the surface; waste rock would be transferred to the East Boulder adit level for transportation to the surface. See response to comment 14-26. |
| 37-8 | A provisional permit for groundwater extraction has been granted under approval provided in the existing exploration permit which was obtained by SPGMR following the release of the Jackpine EA and Decision Notice, as amended (see Appendix B). Also, see responses to comments 8-1 and 10-5. |

| Letter and Comment Number | Response |
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| 37-9 | Environmental impacts of spray evaporation or irrigation have not been considered in detail because, with the exception of the tailing impoundment, the East Boulder permit area is not suitable for this technique of water disposal if nitrate, metal, or salt concentrations are high. Spray irrigation/evaporation may occur on the tailing impoundment.<br><br>Percolation ponds should easily handle the large volumes of water produced by the mine. The surficial geology is highly porous and transmissive, meaning that water would infiltrate quickly through the bottoms of the ponds and move through the subsurface. However, it would be important to make sure the ponds do not clog up with fine particles. Periodic cleaning or scraping can reduce this possibility. If clogging occurs to such an extreme that infiltration is impossible new ponds would be constructed. |
| 37-10 | The water quality data base is more extensive than indicated by Table 2.3-6. The information presented here was chosen to reflect conditions during one discrete sampling interval. However, additional water quality information has been added to this EIS to establish a baseline affected environment and predict potential impacts to surface waters (Sections 3.2 and 4.2) and groundwater resources (Sections 3.3 and 4.3). Figure 3.2-2 has been added to the EIS to show the various surface and groundwater monitoring locations used to develop an environmental baseline. |
| 37-11 | Information on the effects of helicopter noise has been added 4.15.2. Helicopters would only be used in the case of emergencies or for wildlife surveys. Helicopter flights would originate from Bozeman. |
| 37-12 | It is unknown at this time what quantities of explosives would be stored on site. Explosives storage areas would be designed in accordance with requirements of the Mine Safety and Health Administration, and suitably located in accordance with 30 CFR Part 57.6. Buildings typically used include metal, double locked powder magazines designed to withstand large impacts. However, it should be noted that all explosives would be moved underground for storage once the mine has sufficiently developed. |
| 37-13 | See response to comment 9-1. |
| 37-14 | The solid waste generated in Big Timber and Sweet Grass County as a result of increased population has been calculated and the new landfill would have sufficient capacity. See Section 4.14.2.5 and the Hard Rock Impact Plan. |
| 37-15 | Traffic projections are presented in Table 2.3-9. SPGMR would limit delivery of supplies and materials to the mine to daylight hours. Plans for upgrading SG31 are being made with Sweet Grass County under the Hard Rock Impact Act, plans for upgrading FS205 are discussed in Section 4.10.2. See response to comment 9-1 regarding the bussing plan. |

| Letter and Comment Number | Response |
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| 37-16 | SPGMR would be responsible for environmental monitoring subject to agency approval and inspection. Checks on the monitoring programs would be conducted to verify SPGMR's monitoring efforts and effectiveness of mitigative responses. Detailed monitoring plans would be required and must meet the monitoring objectives outlined in this EIS, prior to agency approval and project implementation. |
| 37-17 | See response to comment 9-4. |
| 37-18 | As noted in previous comment responses (9-5, 10-11, and 11-1), specific details concerning design of a wastewater treatment facility cannot be developed at this time. However, if a treatment facility is required it would be sited within the permit area. Additional information regarding wastewater treatment techniques and general configurations has been added to Section 2.4.4. |
| 37-19 | Should wetlands be lost to project development, appropriate compensations would be determined by the Forest Service and U.S. Army Corps of Engineers. The agencies wish to stress that "compensation" mitigation is not as desirable as preventing impacts to an existing resource. The mitigations and modifications contained in Alternative 7 were developed using this philosophy. |
| 37-20 | Adits at higher elevations would be plugged to prevent surface water from channeling into the mine workings. |
| 37-21 | See Section 2.5.2. |
| 37-22 | See response to comment 14-2. |
| 37-23 | See responses to comments 9-1 and 9-9. |
| 37-24 | See Section 2.5.8. |
| 37-25 | See response to comment 14-27. |
| 37-26 | SPGMR has committed to using upgraded muffler systems on all vehicles. Noise levels would be monitored by SPGMR should the public or the agencies identify an apparent elevated noise problem associated with mine-related vehicles. |

| Letter and Comment Number | Response |
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| 37-27 | Two projects, M7 and M8, were inadvertently left off the list of projects of concern in Section 2.7. Both are active mining claims. The following text from the Stillwater Complex IRA (FS 1991) explains the designations of Figure 2.6-1:<br><br>M7 Whittaker exploration permit, East Chippy Creek. (Exploration was conducted in 1990. Further activity is unknown at this time, assume drilling program sometime between 1990-1995 with associated NEPA/MEPA and reclamation to follow).<br><br>M8 Interwest exploration permit, Graham Creek. (Exploration was conducted in 1991. Further activity is unknown at this time, assume drilling program sometime between 1990-1995 with associated NEPA/MEPA and reclamation to follow). |
| 37-28 | The mitigation measures listed in Section 2.5 do attempt to mitigate the fifty-two impacts listed in this comment, as you noted. Some of the impacts may also be mitigated through other measures such as Determination of Eligibility to the National Register of Historic Places for cultural resource impacts, the Board of Health and Environmental Sciences' pending decision on water treatment alternative for impacts to water resources, and the Hardrock Impact Plan for socioeconomic impacts.<br><br>As described at the beginning of Section 2.5 mitigation measures do not necessarily avoid an impact, but should minimize an impact. Monitoring of various resources would also occur to determine if an impact is increasing or decreasing over time. The agencies have the discretion to add or delete mitigation measures as conditions change.<br><br>The agencies appreciate the effort put into this comment, and agree impacts from this project represent a significant change to the environment. Be assured all impacts are looked at and carefully weighed during the decision-making process, including the unavoidable impacts and those only minimized through mitigation. It should also be noted some beneficial impacts would result from this project. |
| 37-29 | Platinum and palladium are considered valuable minerals, however SPGMR is not required to prove profitably. |
| **Favinger - October 10, 1991** | |
| 38-1 | Degradation of the East Boulder River and other surface waters and groundwater is of great concern to the agencies and most of the public, judging by the volume of comments addressing this issue. We have attempted to provide a suitable range of alternatives to reduce or eliminate water degradation from occurring. Ultimately, as described in the EIS Summary and Section 2.8, the decision regarding water treatment will be based on the Board of Health and Environmental Sciences conclusions. |

| Letter and Comment Number | Response |
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| 38-2 | As described in an earlier response (9-1) a bussing program would be implemented which would greatly reduce the number of vehicles traveling to the mine facilities. This is further described in Section 2.3.18 and evaluated in Section 4.10.2. |
| 38-3 | As described in Section 2.8, the agencies have identified the existing accessway, SG31, as the preferred road alternative. The agreement by SPGMR to bus workers to the mine site played an important role in the agencies considerations because of the lessened impact on those people living in the East Boulder River valley. The agencies will continue to meet with concerned citizens about this issue and develop strategies to minimize impacts. |
| 38-4 | The agencies share concerns about reclamation of the tailing impoundment. A stipulation has been added into Alternative 7 requiring SPGMR to submit a more detailed reclamation plan for the impoundment for agency review and approval prior to impoundment construction. This and other mitigations for tailing impoundment reclamation are described in Section 2.5.6.1. |

Woolsey - October 10, 1991

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| 39-1 | As discussed in the response to comment 38-1, the agencies share the public concerns about degradation of East Boulder River water quality. The Board of Health and Environmental Sciences must decide whether SPGMR should be granted permission to modify the existing water quality and if so, to what degree modification can occur. We have used this EIS to develop a range of alternatives and evaluate their impacts for the Board to consider when making this decision. |
| 39-2 | SPGMR has agreed to implement a bussing program which should substantially lower the number of vehicles traveling to the mine site on a daily basis. This is further described in Section 2.3.18 and Section 4.10.2. |
| 39-3 | Based on the extensive comment regarding this issue during the public scoping process, EIS development, and review of the draft EIS, the agencies understand the magnitude of concern many citizens have about road access to the mine site. As described in Section 2.8, the agencies have identified the existing accessway, SG31, as the preferred road alternative. The agreement by SPGMR to bus workers to the mine site played an important role in the agencies' considerations because of the lessened impact on those people living in the East Boulder River valley. The agencies will continue to meet with concerned citizens about this issue and develop strategies to minimize impacts. |
| 39-4 | See response to comment 38-4. |

| Letter and Comment Number | Response |
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**L. Iverson - October 10, 1991**

40-1 Vegetation across the study area, which includes the three potential permit areas, is described, mapped, and has species listed for each plant community type in a previous document (Beak 1981). No maps exist at the same scale to facilitate a comparison of pre- versus post-reclamation vegetation in specific areas and to aid in identification of acres of each vegetation type to be disturbed.

The Metal Mine Reclamation Act (MMRA) does not require reclamation of vegetation to preexisting conditions. The MMRA does require restoration of soil and vegetation to "comparable stability and utility." Therefore, the regulatory agencies must review the proposed reclamation plan and address whether reclamation revegetation mixes restore this "comparable stability and utility." Based on public comments, presence of noxious weeds, presence of rare plant species or other special preexisting vegetation conditions at the site, the agencies can ask the mining company to modify the reclamation plan or mitigate the reclamation plan in the environmental document, record of decision, and/or attach stipulations to the operating permit.

To summarize, the agencies feel that the mining company has addressed "comparable stability and utility" to a large degree, but in response to public comments the following additional mitigations have been added to Alternative 7.

> The same seed mix as proposed for final reclamation would be used on interim reclamation of disturbances, such as soil stockpiles, to test mixes for appropriateness and to develop data to modify final revegetation mixes over the life of the mine.

40-2 The agencies agree that native species should be used and will ask the mining company to modify seed mixes to eliminate non-native species in a modified reclamation plan (unless the introduced species already exists at the site). The following mitigation has been added to Alternative 7.

> The approved seed mixes need to be modified to remove non-native species. These native seed mixes can be modified at any time during the life of the mine with the approval of the regulatory agencies, based on availability of native seed.

40-3 The agencies have asked for a modified reclamation plan to account for wetlands revegetation in Alternative 7.

> The mining company would contact the regulatory agency before any wetlands are disturbed. The regulatory agencies would review disturbances in all wetland areas to determine the revegetation mixture of seed, transplants, and nursery stock needed on a site by site basis.

| Letter and Comment Number | Response |
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| 40-4 | The proposed seed mixes would produce comparable stability and utility. However, the agencies will ask the mining company to use native species such as spike trisetum and Idaho fescue at upper elevation sites. The company can propose to establish a limited density of native forbs, shrubs, and other lifeforms for which seed is not available which would be propagated vegetatively or from local seed collections. The mining company will revise revegetation and planting mixes to increase the use of site adapted native species, including nursery developed dominant and subdominant grasses, forbs, shrubs, and/or trees and submit them for approval by the agencies. |
| 40-5 | See response to comment 9-4. In the permit application, the mining company has committed to ripping compacted surfaces and decreasing soil compaction during redistribution.<br><br>The agencies do not expect long-term adverse effects of mixing topsoil and subsoils with 1 percent organic matter contents. The agencies have not required any separation of rocks from the soil during salvage, storage, or replacement. |
| 40-6 | Revegetation success or failure will be monitored by the agencies to the point of bond release. The determination of successful revegetation is a judgement to be made by the agencies. There are no standards for time; the agencies are looking for erosion control, revegetation success (comparable utility and stability), and chemical stability. See response to comment 10-17. |
| 40-7 | The updated Order I soil survey of the East Boulder permit area is referenced as an attachment to the Plan of Operations. Soil stockpiles would be monitored periodically as part of agency inspections. Additions of fertilizer to the stockpiles will be required should the stabilizing vegetative cover show signs of nutrient deficiency. The proposed reclamation plan recognizes the probable need for soil fertilization following soil redistribution over areas to be reclaimed. |
| 40-8 | The county and agencies would evaluate the need for post-closure weed control at the time of bond release based on previous annual weed control reports and current conditions. See response to comment 10-9. |
| 40-9 | Reclamation efforts are monitored by the agencies throughout the life of the mine. State of the art technologies would be utilized. |
| 40-10 | See response to 38-1. |
| 40-11 | See response to comment 9-1 and Table 4-10 in the final EIS. |
| 40-12 | See response to comment 17-25. |
| 40-13 | See response to comment 9-9. |
| 40-14 | The EIS has been modified as suggested. |

| Letter and Comment Number | Response |
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| 40-15 | Revegetation seed mixtures will be reevaluated as noted previously (see responses to comments 14-26 and 40-1) in response to public comments. |
| 40-16 | See response to comment 40-15. |
| 40-17 | See response to comment 40-15. |
| 40-18 | See response to comment 40-15. |
| 40-19 | Agency monitoring of revegetation efforts would occur until bond release. Monitoring would last for an unspecified period of time until the agencies accept the level of revegetation success. See response to comment 36-6. |
| 40-20 | The final EIS has been modified to reflect an average distribution depth of 28 inches for reclaiming the tailing impoundment surface. The agencies believe this depth of soil cover would enable the successful reclamation/revegetation of the stabilized and graded tailing impoundment surface. |
| 40-21 | See response to comment 40-1. |
| 40-22 | See responses to comments 14-26 and 40-1. |
| 40-23 | The proposed seedmixes presented in the draft EIS would likely be effective in revegetating the disturbed areas; however, the long-term effects of using non-native species have not been fully addressed. For this reason the project reclamation plan will be reevaluated, particularly the use of non-native species. See responses to comments 14-26 and 40-1. |
| 40-24 | See response to comment 40-1. |
| 40-25 | The agencies would require revegetation trials including tests of seedmixes to be conducted on soil stockpiles during the life of mine operations. This topic would be addressed in the modified reclamation plan to be required by the agencies (see responses to comments 14-36 and 40-1). |
| 40-26 | See responses to comments 14-36 and 40-1. |
| 40-27 | The Jackpine EA used "practicable" to mean those areas where reclamation seems feasible and possible of being successfully implemented. However, Montana reclamation laws require all disturbed areas to be reclaimed and revegetated. All disturbed areas at the East Boulder project would be considered "practicable" by the agencies in terms of implementing reclamation. |
| 40-28 | The final EIS has been modified to reflect the correction in vegetation habitat types. |
| 40-29 | The agencies believe reclamation of the tailing impoundment is feasible; therefore, the statement "if possible" has been removed from the text of the final EIS. |

| Letter and Comment Number | Response |
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| 40-30 | At the present time there are not thought to be any benefits to having the mine facilities left when mining ceases. However, the agencies reserve the right to evaluate the potential need for retaining facilities at the time of mine closure. |
| 40-31 | Excavated soil materials and minor amounts of fuel or lubricants suspended in runoff could escape best management practices required in erosion control plans; however, the agencies do not anticipate such an occurrence based on the review of all erosion control plans and monitoring of construction near wetlands and riparian crossings. |
| 40-32 | Impacts from stream crossings were addressed in the Jackpine EA (FS 1989). |
| 40-33 | See response to comment 10-25. |
| 40-34 | See response to comments 10-19. |
| 40-35 | The principal tree species to be harvested will be the lodgepole pine. |
| 40-36 | See response to comment 40-1. |
| 40-37 | See response to comment 40-28. |
| 40-38 | The Placer Basin permit area would have approximately 30 acres of new disturbance. |
| 40-39 | Seed for revegetating the upper elevation sites would be collected locally as recommended in Section 2.3.20.1 of the EIS. |
| 40-40 | Soil or suitable growth media would be salvaged at all sites to be disturbed within the Placer Basin permit area. The agencies do not anticipate the need for importing soil materials. See response to comment 14-26. |
| 40-41 | See response to comment 10-15. |
| 40-42 | The final EIS has been modified to clarify which permit area(s) are being addressed in this paragraph. |
| 40-43 | The impact of spraying weeds on the surrounding vegetation is addressed in the Gallatin National Forest Noxious Weed EIS (available from Gallatin National Forest offices). This EIS specifies conditions under which spraying will be conducted to minimize spray drift onto surrounding vegetation. See also response to comment 10-19. |
| 40-44 | The apparent discrepancies in the amount of available soil for salvage in the Placer Basin permit area have been addressed and rectified in the final EIS. |
| 40-45 | See response to comment 3-5. |
| 40-46 | See responses to comments 14-26 and 40-1. |
| 40-47 | The EIS has been modified to provide more information. |
| 40-48 | The agencies believe wetlands replacement is possible. |

| Letter and Comment Number | Response |
|---|---|
| 40-49 | See responses to comments 14-26 and 40-1. |
| 40-50 | See response to comment 10-25. |
| 40-51 | "Best Management Practices" refers to those established in the U.S. Forest Service "Soil and Water Conservation Practices Handbook" May 1988, FSH 2509.22. See response to comment 40-31. |
| 40-52 | Montana reclamation laws require reclamation be implemented and successfully completed as per criteria presented in response to comment 10-17. |
| 40-53 | Table 4.10-2 of SPGMR's East Boulder Project Plan of Operations (1990), as amended, identifies soil salvage acreages, soil types, salvage depths, and estimated salvageable soil volumes for the proposed facilities to be constructed within the East Boulder Adit permit area. Soil materials will be salvaged on the East Boulder Plateau based on plans developed on a site-by-site basis, in concurrence with agencies' requirements. |
| 40-54 | See response to comment 9-4 which includes a reference to the soil survey (see Chapter Eight for a full reference). A copy of this soil survey is available from the Department of State Lands in Helena, Montana. |
| 40-55 | See response to comment 9-4. |
| 40-56 | See response to comment 40-44. |
| 40-57 | The agencies are required by law to ensure successful reclamation. See response to comment 10-17. |
| 40-58 | See response to comment 40-44. |
| 40-59 | The comment is noted. |
| 40-60 | The final EIS has been modified to clarify the statement. |
| 40-61 | The comment is noted. |
| 40-62 | Possible long-term impacts could include increased levels of sediment from dust and surface runoff should road maintenance (surface dust control and diversions) and erosion control features not be effective. |
| 40-63 | Impacts of soil erosion are the loss of plant growth media and the sedimentation of surfaces and/or streams downgradient. Reclamation failures prior to bond release would be mitigated by SPGMR in coordination with the agencies. |
| 40-64 | Stockpiled soils lose organic matter, nutrients, and microorganisms over time. |
| 40-65 | See response to comment 40-5. |

| Letter and Comment Number | Response |
|---|---|
| 40-66 | Approximately 7 acres within the East Boulder Adit permit area would be required for topsoil material storage (see Table 4.4-2 and Figure 3.1-1 of the East Boulder Project Plan of Operations). Topsoil material storage areas on the East Boulder Plateau will be of minimal size. |
| 40-67 | The high rock content of soils to be salvaged may make salvage operations difficult; however, salvage of soils with 50 percent or less coarse fragment content would be required. See response to comment 18-13. |
| 40-68 | Topsoil (A horizon) and subsoil (B horizon) are likely to be mixed during salvage, stockpiling, and replacement. See response to comment 40-5. |
| 40-69 | A decrease in initial soil productivity following soil replacement would be expected due to the reduced nutrient availability and cycling capability (loss of organic matter and microorganisms). |
| 40-70 | Limited soils for salvage do exist in the area. See response to comment 40-67. |
| 40-71 | The manner in which soil would be salvaged by SPGMR with regards to handling rocks/boulders is not known; however, SPGMR would be required to overcome any problems to ensure salvage of all suitable materials. See responses to comments 18-13 and 40-67. |
| 40-72 | See response to comment 9-4. |
| 40-73 | Although not quantifiable, we anticipate there would be an increase in stream sediment load until disturbed soils adjacent to the stream are stabilized. |
| 40-74 | See response to comment 40-62. |
| 40-75 | See responses to comments 14-26 and 40-1. |
| 40-76 | See response to comment 9-4. |
| 40-77 | See responses to comments 10-17, 10-23, and 40-27. |

**J. Iverson - Rec. October 11, 1991**

| | |
|---|---|
| 41-1 | Analysis of the impacts of the proposed project on surface and groundwater have indicated that with mitigation there would not be a significant loss of water quality in the East Boulder River. Fishing opportunities and other recreation activities which occur on the East Boulder River, including camping at the East Boulder campground, hiking, and hunting, would not be adversely affected by the anticipated changes in water quality. Other impacts to recreation are discussed in Section 4.13 of the EIS. |

| Letter and Comment Number | Response |
|---|---|
| 41-2 | It is true that long-term severe degradation of the environment or the perception of such degradation can result in negative effects on the value of adjacent and nearby property. However, the surface water degradation which could occur under most alternatives considered in this analysis would not present unacceptable impacts due to the low concentrations of compounds which could enter the surface water systems. Under these assumptions, property values on the Boulder River would not be affected. |
| 41-3 | As described in the responses to comments 9-5, 10-9, 10-11, 10-12, and 11-1, additional information has been provided in Section 2.4.4 concerning wastewater treatment facilities. Impacts are evaluated in Sections 4.2.6 and 4.3.6. |
| 41-4 | See response to comment 9-1. |
| **Carron - October 12, 1991** | |
| 42-1 | See response to comment 38-1. |
| 42-2 | Thank you for your comments. As described in Section 4.13, the project would cause a significant effect to recreational resources such as hunting, fishing, and camping in the East Boulder River Valley. However, the population associated with the mine would generate a substantial year-round demand for recreation activities and contribute to the recreation-based economy in the area. The federal and state environmental regulations are designed to prevent degradation of the environment.<br><br>Although the agencies do not agree that the East Boulder River valley would be ruined if mining takes place, there is a legitimate concern about future development along the river and travel corridors to the mine site which could cause further degradation of the environment. Careful planning would be required to assure uncontrolled development does not taken place which does not adequately provide for the protection of the surrounding environment. |
| 42-3 | As described in Section 2.4.4, the agencies have developed a range of alternatives for the Board of Health and Environmental Sciences to consider when making a decision whether to allow degradation of the East Boulder River to occur, and if so how much degradation to allow. The agencies final decision will be based on the Board's decision on the nondegradation petition. |
| 42-4 | See response to comment 9-1. |
| 42-5 | If Alternative 7 or Alternative 8 is selected for implementation, SPGMR would be required to prepare a tailing impoundment reclamation plan for review and approval by the agencies prior to mine construction. Section 2.5.6.1 describes this requirement. The reclamation bond would account for tailing impoundment reclamation. |

| Letter and Comment Number | Response |
|---|---|
| **Thurber - October 12, 1991** | |
| 43-1 | This is an interesting proposal which is, unfortunately, technically impracticable. The main prohibition is the West Fork of the Stillwater River which is a drainage laying between the Stillwater Mine and the area proposed for mining in the East Boulder Project. In order to come into the ore zone from this side one or more adits and mine facilities would have to be constructed on the northwest side of the West Fork of the Stillwater. |
| 43-2 | Other than the Frog Pond adit, the other access openings to the ore zone and mine workings would be constructed primarily for worker safety as escape routes and/or ventilation portals. They must be included in the mine operations. |
| 43-3 | See response to comment 9-1. |
| 43-4 | See response to comment 14-3. |
| 43-5 | See response to comment 9-5. |
| 43-6 | Alternative 3 would help reduce visual impacts by providing a more gradual slope on the tailing impoundment. Reclamation would be easier and help to visually screen the facility. |
| 43-7 | The definitions provided in the glossary have in some instances been modified from the technical explanations provided in reference documents such as AGI's "Dictionary of Geologic Terms." The purpose of these modifications has been to make it easier for the non-technically oriented reader to understand the terms. However, upon review it was noted that the definition for mineralization in the draft EIS was indeed unsatisfactory, and it has been changed. |
| **Lohrer - October 13, 1991** | |
| 44-1 | Comment noted. The agencies interpret part of the comment as referring to the decision on water treatment, which reflect the decision by the Board of Health and Environmental Sciences. The agencies believe the Board has the proper authority and decision making process to allow degradation. |

| Letter and Comment Number | Response |
|---|---|
| 44-2 | Capturing a plume of contaminated groundwater arising from a disfunctioning septic system would likely be done by the installation of one or more interceptor wells, or an interceptor trench. The interceptor wells would be more effective if it is determined that the movement of contaminated water is primarily downward. The treatment "stream" (the water to be treated) referred to would be an on-site system established for treatment of mine discharge water. At the least, this would involve a sand filtration unit or flocculating agent to remove metals and some nitrates. Or, it could mean treatment in a wastewater treatment facility. The level of treatment required would depend on what compound discharge concentrations would be allowed, as determined by the Water Quality Act and the Board of Health and Environmental Sciences. For details regarding the water monitoring program see the water monitoring program requirements in Sections 2.5.3 and 2.5.5. Additional measures than interceptor wells are not anticipated since interceptor wells should suffice to capture the contaminated water. |
| 44-3 | See responses to comments 9-1 and 9-9. |
| 44-4 | FAS 298 was originally built in the 1930s but sections of the road have been upgraded since then. The highway is classified as a secondary road and currently supports the maximum legal load limits for highways of this type. Large volumes of heavy trucks generally cause an increase in road defects such as rutting and cracking of the asphalt. See response to comment 14-42. |
| 44-5 | See responses to comments 11-4 and 14-29. |
| **Kiser - October 15, 1991** | |
| 45-1 | See response to comment 9-1. |
| 45-2 | See response to comment 38-1. |
| 45-3 | See responses to comments 9-1, 9-9, 11-4, and 14-29. |
| 45-4 | The agencies would conduct scheduled and unscheduled monitoring visits of SPGMR operations and mitigation compliance. |
| **Testimony - June 5, 1991** | |
| 46-1 | See the last paragraph of response to comment 17-11. |
| 46-2 | See response to comment 9-1. |
| 46-3 | The final EIS has been revised to address this issue. See Section 4.6.2. |
| 46-4 | The tailing impoundment would not meet VQO's. See response to comment 14-27 for further information. |
| 46-5 | See Section 2.5.2 for clarification of surface water control requirements under Alternative 7. |

| Letter and Comment Number | Response |
|---|---|
| 46-6 | An errata sheet was not issued. This has been corrected in the final EIS. |

**Testimony - September 11, 1991**

| | |
|---|---|
| 47-1 | See response to comment 9-1. |
| 47-2 | See the last paragraph of the response to comment 17-11 and response to comment 22-4. |
| 47-3 | See response to comment 15-10 regarding ongoing water monitoring. A request for a modification is an option which is provided for in the law. The Board of Health and Environmental Sciences will decide on SPGMR's request for a modification to existing water quality. |
| 47-4 | See Section 14.14.2.9. |
| 47-5 | The U.S. Congress has determined that mining is an acceptable use on designated public lands. Federal and state environmental regulations are designed to prevent substantial, long-term degradation of the environment. It has not been demonstrated that mining has significant negative effects on tourism and recreation activities, particularly those activities that are not in the immediate vicinity of the mine site. In some localities both historic and active mining operations are major tourist attractions.<br><br>The provisions of the Montana Hard Rock Mining Impact and the Montana Property Tax Base Sharing Act are designed to mitigate many of the effects of the boom and bust phenomenon that sometimes accompanies mining. |
| 47-6 | See response to comment 38-1. |
| 47-7 | The mine discharge water would likely contribute the majority of water requiring treatment. Further clarification is not possible at this time pending a decision by the Board of Health and Environmental Sciences on treatment requirements.<br><br>The maps in the EIS (Figures 2.2-1 and 2.3-2) were developed based on SPGMR's proposed plan, and they do not anticipate a water treatment facility. Possible locations for a facility would include the present site of the main percolation pond, or an area in the south corner of the East Boulder permit area. The settling pond or thickener is called a "clarifier" on the map and is located south of the main percolation pond and north of the main buildings. |
| 47-8 | See response to comment 12-10. |
| 47-9 | See response to comment 44-2 regarding the septic system and the second paragraph of response to comment 47-7 regarding location of a treatment facility. |
| 47-10 | See responses to comments 9-5, 10-9, 10-11, 10-12, 11-1, and 42-9. |

| Letter and Comment Number | Response |
|---|---|
| 47-11 | See response to comment 12-12 regarding dewatering. See response to comment 10-12 regarding a collection system for the tailing impoundment. |
| 47-12 | See responses to comments 3-4 and 11-4 regarding tailing impoundment reclamation. |
| | Alternative 8, Twin Production Adits, is the agencies preferred alternative. As noted in the response to comment 12-13, waste material could not be placed in the adits during mine operations. If there is excess waste rock at the end of mine operations it could be placed into one or both of the adits. However, the agencies would not require that the tailing be removed from the impoundment and placed into the adits since this would not enhance reclamation potential. Further, the agencies believe the impoundment is a more easily monitored and controlled environment for tailing storage than an adit. |
| 47-13 | See response to comment 10-23. |
| 47-14 | See response to comment 10-17. |
| 47-15 | See response to comment 10-24. |
| 47-16 | Section 2.7 list other reasonably foreseeable projects in the vicinity of the proposed East Boulder Mine. Some of these projects are other mining projects. All have been considered in the cumulative impacts analyses presented in Chapter Four. Regarding possible future expansion of the East Boulder Mine, see response to comment 17-9. |
| 47-17 | See response to comment 47-5. |
| 47-18 | See response to comment 10-2. |
| 47-19 | The comments included here have been responded to previously. See responses to comments 9-5, 10-11, and 11-1. |
| 47-20 | See response to comment 11-4. |
| 47-21 | See response to comment 12-12. |
| 47-22 | See response to comment 10-23. |
| 47-23 | See response to comment 10-24. |
| 47-24 | See response to comment 43-1. |
| 47-25 | See response to comment 40-4. |
| 47-26 | See response to comment 9-1. |

## 6.2 DISTRIBUTION AND REVIEW

Copies of this final EIS are being provided to approximately 400 persons who have indicated an interest in the proposed East Boulder Mine Project. In addition, a number of public interest groups, local governments, tribes, and state and federal agencies are also receiving the final EIS. The following were mailed a copy of the final EIS:

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- Montana Department of Health and Environmental Sciences, Water Quality Bureau, Cogswell Bureau, Helena, MT
- Gallatin National Forest Office, Federal Building, Bozeman, MT
- Northern Regional Office, U.S. Forest Service, Missoula, MT
- Big Timber District Ranger Office, Big Timber, MT
- Livingston Ranger District, Livingston, MT
- Big Timber Public Library, Big Timber, MT
- McLeod Post Office, McLeod, MT
- Bozeman Public Library, Bozeman, MT
- Livingston Public Library, Livingston, MT
- Columbus Post Office, Columbus, MT
- Custer National Forest Office, Billings, MT
- Red Lodge District Office, Red Lodge, MT

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|---|---|---|
| Henry Shovic | Soils, Reclamation | PhD Soils<br>MS Industrial & Management Engineering<br>BS Industrial & Management Engineering |
| Sally Orr | Vegetation | MS Geography<br>BA Geography |
| Steve Brandy | Big Timber District Ranger | BS Forest Resource Management<br>BA Physics |
| Teri England | Big Timber District Coordinator | BS Resource Conservation |
| Ray Zubik | Wildlife, Aquatic Ecology & Fisheries | MS Fish & Wildlife Management<br>BS Fish & Wildlife Management |
| Mark Story | Air Quality & Noise, Groundwater, Surface Water | MS Watershed Management<br>BS Wildlife Management |
| Roger White | Geotechnical | BA Architectural Engineering |
| Walt Allen | Cultural Resources | MA Anthropology/Archaeology |
| Frank Cifala | Recreation & Wilderness, Visual Resources, Land Use | MS Natural Resource Management<br>BS Forest Resource Management |
| Gene Gibson | Roads & Transportation, Geology, Geotechnical | BS Civil Engineering |
| Richard Marshall | Socioeconomics | PhD Candidate - Mineral Economics<br>MA Economics<br>BS Business Administration |
| Marion Cherry | Wildlife | MS Range Science<br>MS Wildlife Science<br>AB Psychology |

Montana Department of Health and Environmental Sciences - Water Quality Bureau

| Name | Responsibility | Qualifications |
|---|---|---|
| Abe Horpestad | Water Resources | Ph.D. Limnology<br>MS Botany<br>BS Botany |
| Tom Reid | Water Resources | MS Applied Statistics<br>MS Aquatic Biology<br>BS Aquatic Biology |
| <u>Woodward-Clyde Consultants</u> | | |
| R.W. Bell | Project Manager | BA Distributed Major Biology, Geology, and Chemistry<br>3 years graduate studies in Soil Science |
| Ken Wallace | Assistant Project Manager, Geology | MS Geology<br>BS Geology |
| Robert Scott | Visual Resources, Land Use, Roads & Transportation, Recreation & Wilderness | MLA Landscape Architecture and Environmental Planning<br>BS Urban Recreation Administration and Parks Design |
| Jeffrey Dawson | Wildlife, Aquatic Ecology & Fisheries | MS Botany<br>BS Biology |
| Kip Etheridge | Air Quality, Noise | BS Meteorology |
| John T. Acre | Groundwater | MS Environmental Sciences<br>Specialization: Hydrogeology<br>BS Geology |
| Paul deCurnou | Surface Water | BA Biological Science |
| Elizabeth G. Lack | Biology, Assistant Project Management | BS Forest Biology |
| Dave Jones | Roads and Transportation, Visual Resources, Recreation and Wilderness | MS Natural Resource Planning<br>BS Landscape Horticulture<br>BS Agriculture |
| Elaine Reilly | Water Treatment | BS Chemical Engineering,<br>2 years graduate studies |

| Name | Responsibility | Qualifications |
|---|---|---|
| Sage Murphy | Water Treatment | Ph.D. Civil Engineering<br>MS Civil Engineering<br>BS Civil Engineering |
| Jeff Porter | Water Treatment | MBA<br>BS Mechanical Engineering |

| Name | Responsibility | Qualifications |
|---|---|---|
| Historical Research Associates | | |
| Janene Caywood | Cultural Resources | MA Anthropology<br>BS Anthropology |
| T. Weber Greiser | Cultural Resources | MA Anthropology<br>BA Anthropology |
| Land and Water Consulting Inc | | |
| Barry Dutton | Soils, Reclamation | MS Forestry<br>BS Forestry |
| Gregory Kennett | Vegetation, Wetlands & Timber Resources | BS Water Management<br>Graduate Work |
| Planning Information Corporation | | |
| George Blankenship | Socioeconomics | MS Urban & Regional Planning<br>BA Social Work<br>BA Anthropology |
| Spectrum Engineering | | |
| Don Sutton | Geotechnical, Geology | BS Mining Engineering & Mineral Benefication<br>2 years graduate studies in business |
| Gary Rome | Geotechnical | MS Civil Engineering<br>BS Civil Engineering |
| Dixie Osborne | Drafting | Associates - Drafting |

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APPENDIX A
RESPONSES TO PUBLIC SCOPING CONCERNS

Citizens of Big Timber and surrounding areas raised a number of concerns about the proposed East Boulder Mine Project during the initial public scoping period. These concerns were used in the development of alternatives and were addressed in the analysis for the draft EIS. Concerns were expressed either verbally at public meetings held on June 28 and September 5, 1990 or in written comments submitted to DSL and GNF during the project scoping period. Commentors included private citizens, environmental or resource protection organizations, ad hoc public interest groups, and others.

This appendix provides a summary of questions raised during this process and a reference guide as to where the answer or response to a particular concern may be found in the EIS. In some instances, clarifying remarks are provided to fully address a particular issue. Comments about the mine project, EIS process, etc are not included - they may be found in the public scoping documents made available in July and October of 1990.

| Comment | EIS SECTION |
|---|---|
| **A-1 CULTURAL RESOURCES** | |
| • Are native plants present in the project area which are of significance to Native Americans? Will they be impacted? | Table 3.8-2<br>4.8 |
| **A-2/3 SURFACE WATER AND GROUNDWATER RESOURCES** | |
| • Where does the water from the tailings pond come from? Will it effect water for irrigation below? | 2.3.6.2 through 2.3.6.5<br>4.2.2 |
| • What will be the effects on creeks near the development? | 4.2.2 |
| • What is the size of the settling pond? | Approximately 2.5 acres |
| • Is the water supply adequate? How would it affect the East Boulder River? Will the Company implement any water-saving measures? | 2.3.3.4, 2.3.6.3, 2.3.6.4, 2.5.4, 4.2.2 |
| • What is the chance the adit will drain Camp Lake? | 4.3.1 |
| • Will the 100-foot riparian easement off the East Boulder River receive sufficient protection? | 4.7.2, 4.8.2, 2.5.12 - The proposed mine disturbance is 100 ft or greater away from the river except for areas of bridge crossings and road widenings. |
| • What is the expansion potential of the tailing pond and what are the alternatives? | 2.4.1.3, 2.4.1.2 |

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| • How much water will leak through the liner via osmosis? Leakage rate should be measured, flow path located, and chemicals identified. If water quality standards are violated, will the appropriate regulation be triggered? | 2.3.4.1, 2.5.3<br>yes-if such violations can be documented |
| • The adit will go beneath Canyon and Brownlee Creek drainages. What will be the impacts? Dewatering? | 4.3.1 |
| • Will a baseline rate of flow for streams and springs be established? An interruption in water flow could modify land use patterns of wild life and riparian vegetation; therefore, stream and spring flow that could be interrupted by mining activity should be periodically monitored during the life of mine. Will effects of flow interruption be documented? | 2.5.3, 3.2.1, 3.2.2, 3.3, 4.2.2, 4.3.2 |
| • Are sulfides, dust, copper and human waste organisms included in water monitoring? What other heavy metals? | 2.5.3 - Mitigation to monitor water resources has been included as part of Alternative 7. The types of analyses, and monitoring locations and frequencies, will be defined in the monitoring plan which is to be approved by DHES prior to mine operation. |
| • Will the sampled water be taken from the exact same site as the baseline samples were taken from? | See previous response. |
| • Where will monitoring wells be located? | See previous response. |
| • Will springs be included in the monitoring program, for water quality as well as quantity? | See previous response. |
| • Who will collect and analyze water samples; an unbiased private firm? | See previous response. |
| • Is the mine required to take periodic samples of stream sediment to insure protection of aquatic biology? | See previous response. |
| • Would stemming the tunnels be considered as a method of protecting water quality? | No-2.5.1 |
| • As per plan of operations, some water borne minerals are below detection limits. Will future readings that might be above detectable limits be attributable to | 2.5.3, 4.2.2, 4.3.2 |

| | | |
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| | mining activity? Will they monitor for those minerals after the mine starts? | |
| • | Is the septic system sufficient for soil conditions? What will happen if monitoring shows migration of organisms to water? | 2.3.15, 2.5.3, 4.2.2 |
| • | Is the water monitoring plan sufficient to describe the existing springs and creeks so that any impacts from mining are noticed? | 2.5.3-See previous response regarding monitoring plan |
| • | How much leachate is expected from the tailings pond? | 2.3.4.1 |
| • | What will be the presence of nitrogen in the outflow water from the adit, from blasting? | 4.2.2, Table 4.2-1 |
| • | What will be the procedure to handle the poorer quality water which is generated in the adits? | 2.3.6.5 |
| • | Will sediment control and monitoring measures be taken to ensure no impact on fisheries resources? | 2.3.6.5, 2.5.3, 2.5.4 |
| • | Will chemical control of leachate and monitoring of tailing and waste rock areas be required? | 2.5.7, 2.5.3 |
| • | What are the extent of SMC water rights on the East Boulder? Will this impact or adversely affect downstream users? | 2.3.6.3, 2.5.4 |
| • | Is the Montana water degradation law being (or will it be) obeyed? | 4.2.2, 4.3.2 |
| • | A percolation pond will be left on-site after the mine ceases operation to catch water flowing from the adit. What will be the acid forming potential of this water after the mine closes forever? | Table 2.3-6, 2.3.6.5, 2.5.1, 2.5.3 |
| • | What is the potential for acid mine drainage formation in the water from the adits during operation and after the mine is shut down? | Table 2.3-6, 2.3.6.5, 2.5.1, 2.5.3, 2.5.7 |

## A-4 SOILS

| | | |
|---|---|---|
| • | Is detailed soils information concerning reclamation available? | 2.3.20.2, 2.3.20.8, 2.5.9, 4.4.2 |

## A-5 GEOLOGY

| | |
|---|---|
| • What emergency controls and evacuation measures are available in the unlikely case seismic activity should open up the tailing dam? | Table 2.3-4, 2.3.4.3, 2.5.10 |
| • Will the analysis of the response of the tailing dam and pond in their most vulnerable condition to a large earthquake (maximum foreseeable level) be presented? | Table 2.3-4, 2.3.4.3, 2.5.10, 4.5.2, 4.5.9 |

## A-6 WILDLIFE

| | |
|---|---|
| • How will wildlife be monitored? | 4.6.2; Proposed mitigation measures for wildlife will reduce impacts so that additional monitoring is not required. |
| • What has been the experience at other mines about effects on wildlife (e.g. poaching and hunting)? | 4.6.2 |
| • Are there any missing species that should be looked at other than the "species of interest" in the wildlife impacts studies? Will the threatened and endangered species be evaluated? | 3.6.3, 4.6.2 |
| • Is there a potential for contamination of wildlife by mine processes and the chemicals used? | 4.6.2 |
| • Will facilities be fenced to keep wildlife out? | 2.3.14, 2.5.11 |
| • Increased road kills may impact eagles feeding behavior - how will that be controlled/monitored? | 4.6.2, 2.5.11, 4.6.7 Appendix B, page 3 |
| • Will there be wildlife enhancement programs in East Boulder? | 2.6.1, 2.5.11 |
| • Will indicator species be determined? | 3.6.2, 3.6.3, 3.7 |
| • Will hunting increase due to easier access, more people? | 4.6.2, 4.13.2.2 |
| • What other increased access impacts will occur? | 4.13.2 |
| • Will there be increased hunting pressure on reintroduced bighorn sheep? What will be the impacts on the sheep? | 4.6.2 |

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| • | Will there be a greater potential for poaching and motorized incursions into wilderness? What will be the impacts? | 4.6.2, 4.13.2 |
| • | Harlequin ducks, a sensitive species, are probably located in this drainage. How will they be monitored/protected? | 3.6.3, 4.6.2 |
| • | Will there be further detrimental impacts on the already-declining black bear population of the area? | 4.6.2 |
| A-7 | AQUATIC BIOLOGY | |
| • | Will there be increased pressure on the Boulder fishery? What kind of impacts will occur? | 4.7.2 |
| • | Will cumulative impacts to local and downstream fisheries be evaluated? | 4.7.8 |
| A-8 | VEGETATION, WETLANDS AND TIMBER RESOURCES | |
| • | What steps will be taken to prevent destruction of riparian habitat by road building? | 2.3.14, 2.3.20.3, 2.5.6, 2.5.12 |
| • | Will noxious weed control be environmentally safe? | 3.8.6, 4.8.2 |
| A-9 | AIR QUALITY | |
| • | How will the mine affect air quality? Will it be detrimental? | 4.9 |
| • | Will there be adequate dust control measures? | 2.3.19.3, 2.5.6, 2.5 |
| • | How will dust be prevented? Will tailing be kept wet to prevent dust escape? | 2.3.19.3, 2.3.20.3, 4.9.2 |
| • | What are the possible air pollution impacts from the generation of 3-4 megawatts of power on-site by generators? | 4.9.1, 4.9.2 |
| • | Does the milling process take place in closed containers? If not, are there filtering provisions to outside air? | 2.3.3, 2.3.3.1, 4.9.2 |

## A-10 TRANSPORTATION

| | |
|---|---|
| • How much commuter traffic will there be? | Table 2.3-9, 4.10.2.2 |
| • Will commuters be bussed, car pooled, or will they drive individual cars? | Table 2.3-9 |
| • Will the company provide worker transportation? | Table 2.3-9, 2.5.6 |
| • If bussing or car pooling is planned, why is there a 200 car parking lot designed in the mine plans? | 2.3.12.2, Table 2.3-9 |
| • Will the company make a commitment to reduce or control traffic to the mine? | Table 2.3-9, 2.5.6 |
| • Will vehicular traffic be limited by the company to reduce the potential for accidents, road maintenance, etc? | Table 2.3-9, 2.5.6 |
| • Will the company provide a staging area in Big Timber to haul workers and materials? | Table 2.3-9, 2.5.6 |
| • Will there be adequate highway patrol by police officials to enforce safe driving? | Effects on traffic safety and law enforcement are documented in Sections 4.10.2 and 4.14.2.5. Response to identified impacts, including the necessary law enforcement requirements, would be developed in the Hard Rock Impact Plan. |
| • The experience on the Stillwater (mine) side is that a lot of traffic goes up and down the roads. More people ride the vans in the winter than in the summer. Will mandatory bussing be part of the condition for employment at the mine? | 2.5.6 |
| • What route would trucks carrying concentrate take through Big Timber? | McLeod Street unless determined otherwise by city |
| • How many ore trucks will use route 291 per day? | Table 2.3-9 |
| • What is the expected generation of solid waste and the frequency of hauling it away? | Based on Stillwater mine, 70-75 tons/month, requiring 5 trips/week by the county. |

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| • Will the potential for spills during transport of chemical reagents for the mill, and for fuel and other hazardous substances be addressed? | 2.5.15 |
| • During exploration, will SPGMR control driving speeds? | No. Not SPGMR responsibility, except on mine site. County would enforce driving speeds off of Forest Service lands, and GNF would enforce laws on Forest Service controlled lands. Hard Rock Impact Plan may address law enforcement capabilities. |
| • Will the speed limit be enforced? Will there be enough police to do so? | No. Not SPGMR responsibility, except on mine site. County would enforce driving speeds off of Forest Service lands, and GNF would enforce laws on Forest Service controlled lands. Hard Rock Impact Plan may address law enforcement capabilities. |
| • If the road is hazardous, who is financially responsible for changes? | The county, SPGMR and GNF would make arrangements through the Hard Rock Impact Plan to resolve financial responsibility for road upgrades and maintenance. |
| • Who pays for dust control? | The county, SPGMR and GNF would make arrangements through the Hard Rock Impact Plan to resolve financial responsibility for road upgrades and maintenance. |
| • Will SPGMR control dust? | 2.3.19.3 |
| • Will there be adequate dust control measures? | 2.3.19.3, 2.5.6 |
| • A resident near the Jardine Joint Venture Gold Mine had his well contaminated by dust retardants. How will this be prevented? | 2.5.6 |
| • Are other road access alternatives still being considered? What are they? | 2.4.2, 2.4.2.1 |

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| • What is the company's preference about road location? Has the Forest Service considered alternative road locations? | 2.4.2, 2.4.2.1 |
| • Why not have access from the Stillwater Mine side? | 2.4.2.2 |
| • Who will have the tax burden of new roads or road improvements? | 4.14.1.9 |
| • How will county and Forest Service roads be modified to handle traffic? | 4.10.2.2, Table 5-1 |
| • Will the Main Boulder Road be upgraded between 8 and 11 miles (before the second bridge)? | Not currently planned, but could be included in the Hard Rock Impact Plans |
| • Who pays to build and maintain roads, now and in the future? | 4.14.1.9 |
| • Are there any plans to upgrade Swingley Road to Livingston? | No |
| • Who's responsible for maintenance, including snow removal? | County, GNF, & SPGMR |
| • How will road maintenance outside the mine permit area be paid for? | 4.14.1.9-Depends on Hard Rock Impact Plan |
| • What work, specifically, will the company want to have done on the East Boulder Road to upgrade it? | 4.10.2, 2.3.9 |
| • Are there plans to widen and pave the road to the mine site? | 4.10.2, 2.3.9 |
| • Will there be potential conflicts between ranching/livestock activities and mine traffic? | 2.3.14, 4.11.2, 4.11.4 |
| • How will increased traffic affect aesthetics at campground? | 4.13.2.1, 4.13.2.2 |
| • If traffic is routed from the main Boulder directly to the freeway, can tourists use that road and not go through Big Timber? | Tourist use would depend on conditions set when approval for a new highway entrance/exit is granted, if granted. |

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| • | Will the EIS examine an alternative in which the workforce is required to commute by bus? | Table 2.3-9, 2.5.6 |
| • | A description of the type and frequency of haulage equipment going to and from the mine site is lacking. Will this be included, as well as number of axles on trucks and equipment, weight, etc. on a daily or weekly schedule? | Table 2.3-7, 2.3.9.1, Table 2.3-9, 4.10.2 |
| • | Is a 200 car parking lot really necessary? (It might encourage employees to take their own car). | 2.3.12.2, 2.5.6 |
| A-11 | LAND USE | |
| • | Will development stay in one location or would it move around, thus possibly affecting grazing permits later? | 2.6.3, 2.6.4 |
| • | To what extent will land use change from agriculture and recreation to residential? | 4.11.2, 4.11.4, 5.11 |
| A-12 | VISUAL RESOURCES | |
| • | What will be the visual impact of an embankment 140 feet high and an unreclaimed slope? | 4.12.2.2, 4.12.2.3 |
| • | Will the new power line affect the visual quality of the valley? | 4.12.2.5 |
| • | Can the electric power line be buried to maintain aesthetic enjoyment of Boulder Valley? | No-voltage requirements (69kV) are too high for burial. |
| A-13 | RECREATION AND WILDERNESS | |
| • | Will there be a parking lot at the end of the road (near the mine) for recreationists? | 2.5.8 |
| • | Will motorized recreation be displaced? | 4.13.2.2 |
| • | Will access to trails, backcountry in back of the portal area be maintained? | 4.13.2.2, 2.5.8 |
| • | What will be the changes and possible restrictions to present levels of recreational activity? | 4.13.2.2 |

## A-14 SOCIOECONOMICS

| | |
|---|---|
| • Will mine people be integrated with the community? | 4.14, 4.14.1.5 |
| • Will cumulative effects, both positive and negative, be considered for the Stillwater Complex and nearby communities? | 4.14.3 |
| • How will the population increase affect law enforcement, the judicial system, rehabilitation, social workers, and programs needed? | 4.14.1.6 |
| • We need a good long term plan with sufficient lead time to respond to school, water, and sewer impacts. Will this be developed? | 1.4, 4.14.1.9 |
| • What will be the impact on current postal services (facilities and personnel)? | Not evaluated in this EIS |
| • Will there be enough classroom space? | 4.14.1.8 |
| • County zoning needs must be identified. What, when and how long do they take? | 4.14, 4.14.1.5 |
| • Will infrastructure needs be developed in advance of activity at the mine? | 1.4, 4.14.1.9 |
| • Is there adequate emergency response capability to cover mine activity? | 4.14.1.6, 4.14.1.7, 2.5.15 |
| • Will the mine be using the landfill (proposed for NE side of Big Timber) and if so, what materials would be placed there (by the mine)? | 2.3.16, 4.14.1.6 |
| • Does the mine company plan on helping to lessen the County planning staff by assisting with salaries of additional planning personnel? | 1.4, 4.14.1.9 |
| • Will qualified people with appropriate degrees be hired to assist in County planning? | 1.4, 4.14.1.9 |
| • How many of the local population might/will be employed? | 4.14.1.2 |
| • What type of job qualifications will be required? | 4.14.1.2 |

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| • | How many workers other than miners will come in (e.g. employees for stores, bars, schools, etc.)? | 4.14.1.2 |
| • | Will locals be hired and trained? ("This is critical!) | 4.14.1.2 |
| • | Will the Forest Service staff at Big Timber be expanded? | Unknown, but adequate coverage will be provided. |
| • | Will the GNF/DSL staff that does compliance be skilled and knowledgeable about all phases of mining operation? | Yes |
| • | Will professional people (i.e., engineers, PhD's, etc.) already living in the area be given the opportunity to compete for management or professional positions? If so, what percentage will be hired? | Yes; unknown |
| • | Does the company intend to provide housing? | 4.14.1.5 |
| • | What are rental prices in Livingston compared to Big Timber? Would people go to Livingston for housing? | 4.14.1.5 |
| • | Would anyone be allowed to live up there (East Boulder)? | No, public property except on the inholdings |
| • | Rental rates for those who are retired (fixed income)? What would be the overall impact on those people? | 4.14.1.5 |
| • | Where would trailer courts be put? | 4.14.1.5 |
| • | What type of housing will be needed/available, and where? | 4.14.1.5 |
| • | Property values might be affected adversely by mining and related activities, both directly and indirectly throughout the local region. Will this be explained? | 4.14.1.5 |
| • | If there is a community built at the site, sewage disposal needs to be evaluated. Will it? | 2.3.15 |
| • | What are the effects on existing economy - ranching, dude ranch, timber harvest? | 4.14 |
| • | In case of drop of mineral value, how would the company scale the operations in terms of personnel and impact of reduction of services in Big Timber? | 4.14.1.11 |

| | | |
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| • | What will be the impact on the PGM (platinum group metals) supply in the United States if the mine doesn't happen? | 1.2 |
| • | Will the mine shut down if PGM prices drop? | 4.14.2.10 |
| A-15 | NOISE | |
| • | Noise pollution is a concern. What kind of noise reduction efforts will be made?. What about noise from machinery, including road improvement and road maintenance efforts? | 4.15.2, 2.5.14 |
| • | Noise pollution and reduction efforts - who has estimated the effect on the wildlife and the extent of contamination into the wilderness? This is important because there are only a few places on earth that the environment is not affected by the noise of machinery. | 4.15.2, 4.6.2, 2.5.11, 2.5.14 |
| • | Aircraft activity and noise surrounding the proposed site are very important to consider to insure there is no increase from the present. Will this be evaluated? | 4.15.7, 2.5.11, 2.5.14 |
| • | Noise pollution- how much, how far? Will it reach the wilderness? | 4.15.2 |
| • | At what decibel or noise level will mitigation take place? How will it (mitigation) take place? | 2.5.11, 2.5.14 |
| A-16 | RECLAMATION | |
| • | Is there sufficient bonding to reclaim the area in the future? | 1.4 |
| • | How long will the company be responsible for weed control over the whole area including disturbed land and roads? | Until release of the revegetation bond. |
| • | Leafy spurge is a big problem; the Forest Service has done a good job trying to control this noxious weed, how will it be controlled at the mine? | 4.8.2 |
| • | What is the intent for leaving buildings? Is this for future mine expansion? | 2.3.20.4, 2.3.20.5 |
| • | Will the tailing dam be revegetated? | 2.3.20.7, 2.5.5 |

| | | |
|---|---|---|
| • | Are there temporary and permanent waste rock piles? What will be the effect from these? | 2.3.20.5, 2.5.7 |
| • | Will there be a detailed reclamation plan in the EIS? | 2.3.20, 2.5.5 |
| • | What will be done to the holding ponds after the life of mine? | 2.3.20.4, 2.5.5 |
| • | What species will be used for reclamation? Where is precipitation data? | Tables 2.3-10, 2.3-11, and 2.3-12<br>Table 3.9-4 |
| • | How will the tailing pond and dam be reclaimed so they are not as visually and physically intrusive as during mine operation? | 2.3.20.7, 2.5.5, 2.5.13 |
| • | Will the tailing pond be stabilized so it can never leak into the surrounding environment? How will this be done? | 2.3.20.7, 2.5.10, 2.5.3 |
| • | Water flows that have been modified by the mining company should be returned to their original state. Will they be? | 2.3.20.6, 2.5.4 |
| • | How the area in Placer Basin is to be handled was not very clear in terms of reclamation or operation. Will this be better defined? | 2.3.12.4, 2.3.20.5, 2.5.16 |

A-17 HEALTH AND SAFETY

| | | |
|---|---|---|
| • | How will safety in the event of the following scenarios be handled? | |
| - | Solid material or liquid spills of toxics | 2.3.3.3, 2.5.15 |
| - | Underground cave-ins | 2.5.15 |
| - | Permanent mine shutdown | 2.3.20.5, 2.5.1 |
| - | Fire | 2.3.17, 2.5.15 |
| - | Accidents and medical attention | 2.5.15 |
| - | Evacuation of downstream residents | 2.5.15 |
| - | Traffic accidents | 2.5.15 |

| | | |
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| | - Temporary mine shutdowns | Agencies would require public safety and environmental safeguards stay in place during temporary or permanent mine shutdowns. |
| | - Drop in price of platinum group metals | 4.14.2.10 |
| • | Will the tailing pond construction be done in a safe fashion? | 2.3.4.1, 2.5.10 |

A-18 PERMIT PROCEDURES

| | | |
|---|---|---|
| • | Who decides what reasonable alternatives are, and what criteria do they use to determine reasonable alternatives? | 2.1 |
| • | Does the project proponent get to review the EIS Draft before it goes to the public? | No, with the exception of Section 2.3, Description of Proposal |
| • | The bureaucracy is taking too long to issue the permit. Why? | 1.3, 1.4 |
| • | We need a central task force to coordinate activities with representatives from all interest groups. Did this happen? | No- task force was not formed. |
| • | Amendments to the "Operating Plan" should be made the subject of public review. Will they be? | Yes |

APPENDIX B
JACKPINE PROJECT EXPLORATION ADIT
DECISION NOTICE AND FINDING OF
NO SIGNIFICANT IMPACT AND
SETTLEMENT AGREEMENT

DECISION NOTICE
and
FINDING OF NO SIGNIFICANT IMPACT

for

Jackpine Project Exploration Adit
Stillwater PGM Resources
Sweet Grass County, Montana

Big Timber Ranger District
Gallatin National Forest

## I. INTRODUCTION

Stillwater PGM Resources (SPGMR), a partnership of Manville Sales Corp. and Chevron Resources, has submitted plans to construct an exploration adit on their mining claims in the Beartooth Mountains of south central Montana. The area proposed for exploration lies within the Big Timber Ranger District of the Gallatin National Forest on land open to mineral entry. The proposed adit site is located in the East Boulder Valley approximately 25 air miles southwest of Big Timber, Montana in Township 4 South, Range 13 East, Sections 11, 14 & 23 (refer to map at the end of this document for a general location).

The purpose of the proposed adit is to evaluate a platinum/palladium mineralized zone in the Stillwater Complex. The Stillwater Complex is a layered geological formation that is known to contain platinum group metals. The Complex extends from near Nye, Montana to the Froze-to-Death Creek area of the Main Boulder River, a distance of about 27 miles. The information obtained from this exploration project will be used by SPGMR to determine whether a sufficient ore deposit exists to merit development of a mine.

The exploration proposal contains five major elements: 1) excavation of an exploration adit, 2) support facilities, 3) construction of an access road to the adit portal area, 4) installation of 3 settling/percolation ponds to handle any waste water from the adit, and 5) reclamation. In addition, the Environmental Assessment addresses engineering and geotechnical studies. These activities may include, but are not limited to, subsurface testing from seismic profiles, drill hole construction and analysis, and open-pit trenching.

An Environmental Assessment, prepared by the Forest Service and the Montana Department of State Lands, describes the approved plan of operations and alternatives to the plan of operations. It also describes the environment to be affected and discloses the potential environmental consequences of operation. The Environmental Assessment is on file and available at the Big Timber Ranger District in Big Timber, Montana and the Gallatin Forest Supervisor's Office in Bozeman, Montana.

The Environmental Assessment was developed under the implementing regulations of the National Environmental Policy Act, Council of Environmental Quality, (40 CFR 1500-1508), the Locatable Mineral Regulations (36 CFR 228) and the National Forest Management Act.

This Decision Notice documents the selection of the Jackpine Project - Clearcut Location alternative (Alternative C), which approves Stillwater PGM Resources' amended plan of operations dated December 11, 1987 for an exploration adit on the East Boulder River with the additional mitigation measures listed in this document. In addition, a brief summary of public involvement, alternatives, decision and rationale for the decision are provided. The Decision Notice includes a Finding of No Significant Impact and additional mitigation measures required for approval of the project.

## II. ISSUES, CONCERNS AND PUBLIC INVOLVEMENT

Public involvement occurred in several ways. A public meeting was held in Big Timber on October 21, 1987. Several concerns were surfaced by the 147 people attending this meeting. A 30 day public comment period was initiated after the meeting for written comments, and 26 letters were received. In addition, contacts were made with local elected officials, groups and individuals.

Issues and concerns were recorded at the public meeting and extracted from each letter. These were grouped by similar issue or concern and phrased in the form of a question for the interdisciplinary team to address. These issues and concerns are listed in the Environmental Assessment (Section I. D.) by category. In addition, a response to each issue and concern is provided in the Environmental Assessment Section VI.

The following is a synopsis of the issues and concerns identified during the environmental analysis process. By far the most common concern was for economic development in Sweet Grass County. This concern was manifested in direct jobs, indirect jobs, increased tax base and job opportunities for young people. The second most common concern was for water quality and quantity. This concern also included fish. Social concerns, particularly relating to the county infrastructure, were slightly less common than water quality. These concerns centered on schools, roads, garbage disposal, the sheriff's office, housing and local employment. Another area of concern came from people who would be directly impacted by the project. These concerns mainly dealt with increased traffic, speeding, dust, road maintenance and local land values.

Several other concerns were raised by people and the interdisciplinary team conducting the environmental analysis. In general these concerns related to the effects on recreation, visual quality, wildlife, grazing, timber harvest and the cumulative effects of the exploration project and other Forest Service projects on the area's natural resources.

## III. ALTERNATIVES

From these issues and concerns alternatives were developed to analyze the effect of the project and to identify any mitigation measures necessary to protect the human environment. All of the alternatives considering the exploration contain 5 major elements: 1. excavation of an exploration adit, 2. support facilities (such as a shop, changing house), 3. construction of an access road from the end of the East Boulder Road to the adit portal site, 4. installation of 3 settling/percolation ponds to handle any waste water from the adit, and 5. reclamation. Alternatives are discussed in further detail in Section III of the Environmental Assessment.

The Jackpine Project alternative (Alternative A, Environmental Assessment Section III. A.) is the proposal submitted by Stillwater PGM Resources on May 5, 1987. This alternative builds 3 miles of road from the end of the existing road to the portal site. The portal site is approximately half way between Canyon Creek and Brownlee Creek on the west side of the East Boulder River. The majority of the road in this proposal is located on the east side of the East Boulder River and has two bridge crossings. Adit length is about 11,500 feet.

The West Side Road alternative (Alternative B, Environmental Assessment Section III. B.) was developed by the interdisciplinary team primarily to address the water quality issue. The main drive behind this alternative was to find a portal site that could be reached without crossing the East Boulder River. This alternative identified a general area for portal location which included the area from the end of the existing road to Canyon Creek. Road construction in this alternative is less than 2 miles and does not cross the river. The adit length is between 14,000 feet and 19,000 feet.

The Jackpine Project - Clearcut Location alternative (Alternative C, Environmental Assessment Section III. C.) is the amended plan of operations submitted by Stillwater PGM Resources on December 11, 1987. This amendment resulted from Stillwater PGM Resources' analysis of the West Side Road alternative. In this alternative the company selected a specific portal site for the Jackpine project. This site requires less than 1 mile of road construction and does not cross or parallel the East Boulder River. The adit is about 19,000 feet in this alternative.

There will be other exploration activities associated with this project that would take place under any of the above mentioned alternatives (Environmental Assessment Section III. F.). These activities include short-term proposals for engineering and geotechnical studies, including seismic exploration, open trenching and core drilling. Activities will take place in the lower Dry Fork drainage, the clearcut at the end of the East Boulder Road and in the lodgepole flat surrounding the clearcut.

The "no action" alternative (Alternative D, Environmental Assessment Section III. D.), denies the exploration proposal, is a requirement of the environmental analysis and provides a baseline by which to compare alternatives.

## IV. DECISION

I have selected the Jackpine Project - Clearcut Location alternative (Alternative C). This alternative approves Stillwater PGM Resources' amended plan of operations dated December 11, 1987 for an exploration adit on the East Boulder River with the additional mitigation measures listed in this document.

The selected alternative includes: excavating a 19,000 foot adit, constructing about 1 mile of road, constructing related support facilities, constructing 3 settling/percolation ponds, stockpiling waste rock, mitigation measures and reclaiming the road, stockpile, ponds and support facilities if the company finds the project not suited for mine development. These activities are confined to within 1 mile from the end of Forest Service Road 205 and outside of the Dry Fork drainage. It is anticipated that this project will last about 2 years. Any timber removed for road construction, portal area development, ponds or the stockpile that is not needed by Stillwater PGM Resources will be decked and made available to the Forest Service for sale as posts and poles. At the time of reclamation the Forest Service will decide if any of the road will serve public needs and be retained by the Forest Service.

In addition, I am also approving short-term proposals for engineering and geotechnical studies which will provide engineering data needed to finalize placement of facilities. Activities are likely to include seismic exploration, open trenching and core drilling. These studies will take place in the vicinity of the exploration adit and new road, and a portion of the studies will be conducted in the Dry Fork drainage.

## V. RATIONALE FOR THE DECISION

In selecting the Clearcut Location alternative I considered several items, including: response to public issues, consistency with the Gallatin Forest Plan, cumulative effects of other projects, contribution to U.S. supply of strategic minerals, and the possibility of future mine development.

### Response to Public Issues and Concerns

In response to the public issues of economic development all alternatives, except the no action alternative, will provide a short-term economic boost to Sweet Grass County. The effect is virtually the same regardless of location, except the Clearcut Location will take a few months longer because of the additional adit length. I feel another issue associated with economic development is one of uncertainty. People of this county have been living under the uncertainty of a mine development for several years. Business people have been faced with decisions of expansion or even whether to stay in business without knowing the future of economic growth. Other people moved to the area or remain in the area for its undeveloped character and have not looked forward to industrial growth. However, in either case uncertainty about the future is present. I believe completing this exploration will help clarify some of this uncertainty.

In regard to water quality, the no action alternative maintains the current high quality water in the East Boulder River and provides the

lowest probability of degrading the existing water quality. The possibility of degrading water quality is the greatest in the Jackpine Project alternative (Alternative A), which included 3 miles of road, 2 bridge crossings and a portal area adjacent to the East Boulder River. Of the alternatives providing for exploration, the Clearcut Location (Alternative C) has the least probability of degrading water quality with less than a mile of road, no bridge crossings and the portal being located away from the river (Environmental Assessment, Section IV. B. 1.).

There will be no social change under the no action alternative. Social and economic effects are nearly identical for all alternatives approving the exploration. Differences relate to type of worker and project duration. The Jackpine proposal (Alternative A), with 3 miles of road, will employ construction workers for a longer time than the Clearcut Location (Alternative C), with 1 mile of road. Likewise, the Clearcut Location will employ workers in the adit for a longer time because of the added length of the adit. Overall, it is anticipated that the Clearcut adit will take a month or 2 longer than Jackpine. I believe social and economic effects will be evident in the area but will be of short duration. Many of the skilled workers will come from outside the local area, but the stay for the majority of them will be less than 1 year . I believe schools and housing in Big Timber and possibly Livingston are adequate to handle this short duration influx of people. The McLeod school will not be able to add many new students, however, with limited housing in the McLeod area I do not expect many new students. (Environmental Assessment Section IV. B. 4)

Concerns related to traffic along existing roads are similar for all alternatives approving the exploration. There will be an increase in traffic and dust and an increased probability of accidents. These changes will be tempered through the mitigation measures but will still be evident. All alternatives, with the exception of the no action alternative, have identical impacts because the same mitigation measures are applied to road use regardless of the adit location.

The no action alternative maintains the current situation for wildlife and recreation. For alternatives approving the project the effects on wildlife and recreation are similar in that the more concentrated the activity, the smaller the effect on these resources. The Clearcut Location (Alternative C) is, therefore, a little better than Jackpine (Alternative A). Differences in the effects of alternative locations on wildlife are limited because the key wildlife areas are the Dry Fork and the winter range along the existing East Boulder Road. Regardless of the adit location, the effects on these two areas are the same. In addition, the area from the end of the existing road to the Jackpine location is of less importance to wildlife than the Dry Fork or the winter range, therefore, making it difficult to identify quantifiable differences between alternative adit locations. I believe that the Clearcut Location will have the least impact on wildlife and recreation. In addition, I believe that population levels of wildlife species will not be effected because of the limited area being disturbed, the low wildlife use in the immediate area of the adit and the mitigation measures (Environmental Assessment Section IV. B. 2). A biological evaluation of the effect of

the project on threatened and endangered species found "no effect" on the grizzly bear and peregrine falcon and a "no effect" for bald eagles provided mitigation measures are implemented.

Consistency with the Gallatin Forest Plan

I evaluated each alternative for consistency with the forest-wide goals, objectives and standards presented in Chapter II of the Gallatin Forest Plan. The no action alternative fails to meet goal number 15 (page II-1 Gallatin Forest Plan) which states "Provide for orderly and environmentally acceptable exploration and development of minerals, oil and gas, and geothermal resources". Also there are limits on the Forest Service's discretionary authority to select the no action alternative. If the proposal is reasonable, claimants have a right under the 1872 Mining Law to explore and develop. All other applicable goals, objectives and standards are met by each of the alternatives. Many of these are achieved through the mitigation measures identified with each alternative.

In addition, Chapter III of the Gallatin Forest Plan contains specific Management Area direction. The Clearcut Location and West Side Road alternative are in Management Area 8. The last half mile of road and the portal site of the Jackpine Project are located in Management Area 3 with the remainder of the proposal in Management Area 8. Goals for Management Area 8 (page III-24 Gallatin Forest Plan) are: 1. Provide for productive timber stands and optimize timber growing potential; 2. Develop equal distribution of age classes to optimize sustained timber production and improve vegetative diversity; 3. Allow for other resources if compatible with the first two goals; 4. Meet state water quality standards and maintain channel stability. The management goal for Management Area 3 (page III-6 Gallatin Forest Plan) is: managed essentially in their present condition to protect existing improvements and resources, with minimal investment for resource activities. All alternatives are compatible with these goals. Alternatives providing for exploration will remove timber from the pole size class which will work towards equalizing age class distribution and increase vegetative diversity upon reclamation. The Jackpine Project, with the additional road construction, will provide more access for potential timber management activities. However, the Jackpine Project will detract from the present condition of Management Area 3.

Overall, I believe the Clearcut Location best meets forest-wide goals, objectives, standards and management area direction by concentrating the exploration activity to the vicinity of the end of the East Boulder Road. By limiting the impact area more area is left for meeting the management goals and objectives of the other resources. This location, with mitigation measures, minimizes effects on and potential conflicts with recreation, visual quality, cultural resources, wildlife, fish, range, timber, water, soil, landownership, facilities and fire while meeting goals and objectives for minerals.

## Cumulative Effects

The cumulative effects of this project in conjunction with existing Forest Service activities and possible future activities were analyzed (Environmental Assessment, Section IV. B.). The extent of this analysis was determined by the pattern of use for each resource, thus wildlife concerns covered a different area than water concerns. During the life of this project the majority of the activity will be taking place in the East Boulder and involve timber harvest. Additional activities are planned to begin in 1992 in the Elk Creek area and 1995 in the Deer Creek area, these activities are well after the exploration project is scheduled to be completed.

The activities that would have an effect are the East Boulder Timber Sale (currently in progress) and the Wright Fuller Timber Sale (proposed to be advertised for sale this fiscal year). Both of these sales are west of the project area and south of the East Boulder Road. Sedimentation from these sales is minimal because of location of the sale and the intermittent nature of stream flows. The cumulative effects of these sales and the exploration are well within the limits of stream channel stability expressed in terms of how much of an annual water yield increase the river could safely handle over natural conditions (Environmental Assessment, Section IV. B. 1.)

These sales and associated logging activities will have an effect on the wildlife using the winter range along the East Boulder Road. Some of these animals will be displaced or limited to using only part of their home range (Environmental Assessment, Section IV. B. 2.). Mitigation measures have been included to decrease this impact.

## Contribution to United States Supply of Strategic Minerals

Platinum is a strategic mineral. The United States is the world's largest consumer of platinum, yet we produce less than 2% of the world supply. South Africa is the world's leading supplier of platinum, followed by the U.S.S.R. I believe alternatives approving this project will help evaluate potential reserves.

## Possibility of Future Mine Development

The excavation of this adit is not an irretrievable or irreversible commitment for a platinum mine in the East Boulder drainage. This bulk sample adit proposed by the company is a preliminary operation in mine feasibility studies. The company will evaluate the results from this adit along with other information in considering whether to propose mine development. Just as similar adits driven in the West Fork Stillwater of the River and the Frog Pond area have not resulted in mine development, the same may be true of this proposal. For any future mine development proposal made by the company, the Forest Service will conduct an environmental analysis in compliance with the National Environmental Policy Act prior to approval of development activity.

Summary

The following table provides a generalized tally of the rationale I used in selecting Alternative C.

| | Alt. A Jackpine | Alt. B W.Side Rd. | Alt. C Clearcut | Alt. D No Action |
|---|---|---|---|---|
| Economic Development | + | + | + | 0 |
| Water Quality | -- | - | -/0 | 0 |
| Social Change | - | - | - | 0 |
| Wildlife/Recreation | -- | - | - | 0 |
| Consistency with Forest Plan | -/0 | 0 | 0 | - |
| Cumulative Effects | -- | - | - | 0 |
| Strategic Minerals | + | + | + | - |
| Future Mine | 0 | 0 | 0 | 0 |

+ positive effect
0 no effect or change
- negative effect -- more negative
+/- both positive & negative effect
-/0 slight negative to no effect

Overall I believe the exploration project is in the public interest and that the Clearcut Location (Alternative C) will have the least effects on other resources in the area.

FINDING OF NO SIGNIFICANT IMPACT

I believe the Jackpine Project - Clearcut Location alternative will not have a significant impact on the human environment for these reasons: (Environmental Assessment, Section IV. Environmental Effects)

1. Both beneficial and adverse impacts are minimal because of the short duration of the project (approximately 2 years) and limited surface disturbance (about 20 acres).
2. There will be very few effects on public health and safety.
3. The selected alternative is not in a wetland, floodplain, prime agricultural land, or wild and scenic river.
4. There has been little controversy over the identification or degree of impacts, but people did express concerns on monitoring and safeguarding the resources in the area. This is reflected in the public comments received during the scoping of the project. (also see Environmental Assessment, Section I. D.)
5. The project does not involve highly uncertain, unique or unknown risks.
6. The excavation of this adit is not an irretrievable or irreversible commitment for a platinum mine in the East Boulder River.
7. The cumulative impacts of this project and existing and proposed projects in the area do not have a significant impact on the human environment.
8. No known cultural or historic sites are in the project area.

9. Informal consultation with the U.S. Fish and Wildlife Service has occurred, and they concur with the biological evaluation that this project will have "no effect" on threatened and endangered species, given the mitigation measures are implemented.
10. The project conforms with all applicable Federal, State and local laws for the protection of the environment.

## MITIGATION

During the environmental analysis the interdisciplinary team determined that the best mitigation measure was to design the project to make special protection measures unnecessary. This is best visualized in the Clearcut Location alternative which mitigates much of the concern over water quality by locating the project away from the river.

In addition to mitigation measures found in the Forest Plan and contained in the December 11, 1987 plan of operations, the following mitigation measures will be required for an approved Plan of Operations (Environmental Assessment Section IV. and V.):

### Reclamation

The company will comply with the approved reclamation plan. A reclamation bond will be required by the agencies.

This measure is included to ensure that the land is reclaimed to comparable utility and stability as that which existed before disturbance.

### Soil and Erosion Protection

1. All construction activities will be reviewed by the agencies to insure that adequate measures have been taken to prevent erosion.
2. Stockpiled topsoil will be seeded to reduce wind erosion.
3. Snow removal will be conducted consistent with Forest Service standards.

These measures are provided to reduce soil erosion from wind and water.

### Water Quality

1. The company will implement a water quality monitoring plan designed cooperatively by the state and the Forest Service.
2. The company will obtain all necessary permits related to water quality and water rights as required.
3. Best Management Practices (BMPs) from the "Watershed Management Guidelines for the Gallatin National Forest" dated April 1987 (also see Gallatin Forest Plan page II - 23) will be implemented where appropriate.

These measures are designed to decrease the possibility of any degradation of the water quality of the East Boulder River and to maintain the current fishery.

Visuals

1. Existing forest cover will be retained wherever possible to provide visual screening.
2. Facilities will be designed to blend with natural surroundings.

These measures are to decrease visual impacts.

Fire

Operations must comply with the existing fire plan.

This measure is to prevent forest fires.

Fish and Wildlife

1. A locked gate will be installed at the end of existing Forest Road #205.
2. All food on site will be made unavailable to bears, and garbage will be stored in bear-proof containers until removed from the area.
3. Snow removal operations should not impede wildlife movements across the road.

Measure 1 is to decrease hunting pressure on big game species and to offset the effect of reduced hiding cover and access. In addition, this measure also provides for public safety.The remaining measures are provided to reduce wildlife mortality resulting from conflicts with black bears and wildlife being trapped between the snow berms on the East Boulder Road.

Threatened and Endangered Species

1. Aircraft traffic will avoid flight corridors that interfere with the peregrine falcon reintroduction program. Flight activity will be coordinated with the Forest Service.
2. Roadside carrion will be removed to prevent mortality of bald eagles. This program will be coordinated with the Montana Department of Fish, Wildlife and Parks.
3. The company will continue a policy of discouraging the carrying of firearms.
4. To prevent grizzly/human conflicts, strict control of human refuse will be enforced.
5. The company will insure that employees involved in the Jackpine Project are familiar with the requirements for protection of threatened and endangered species.

These mitigation measures are to limit the possibility of mortality to threatened and endangered wildlife species by avoiding potential conflicts.

Cultural Resources

The company is required to follow the recommendations outlined in the report by Anthro Research, Inc., 1982 for identified sites. Additionally, if previously undiscovered cultural resources are encountered, the operator shall notify the District Ranger and the State Historic Preservation Office.

Although the area has been inventoried and sites identified, the possibility remains that a site may have been missed or is undiscovered; this measure will protect such sites.

Noxious Weeds

The company will be responsible for the control of noxious weeds in the area of operation. This will involve an annual check with a designated Forest Service representative to identify occurrences and determine control measures.

This measure is included to prevent the establishment and spread of noxious weeds resulting from soil disturbance and increased traffic in the area.

General

1. The company will be required to contact the Big Timber District Ranger prior to commencement of ground disturbing activities.
2. Other mitigation measures may be required as project activities proceed. The Forest Service and the Montana Department of State Lands will coordinate with company personnel as necessary.

## Consultation with the U.S. Fish and Wildlife Service for Threatened & Endangered Species

In developing the Environmental Assessment an informal consultation was conducted with the U.S. Fish and Wildlife Service. This was in response to the Biological Evaluation for the Grizzly Bear, Peregrine Falcon and Bald Eagle. The Biological Evaluation determined that this project will have "no effect" on grizzly bears, peregrine falcons, or bald eagles, provided Stillwater PGM Resources follows the mitigation measures pertaining to these species.

## Monitoring and Evaluation

A water quality monitoring program, consisting of collection and analysis of water samples taken monthly during the exploration program from stations upstream and downstream of the adit and percolation/settling ponds as well as 3 groundwater sampling wells located near the percolation/settling ponds, will be conducted by the company and overseen by the Forest Hydrologist and appropriate state agency.

Forest Service personnel will monitor exploration activities on a routine basis for compliance with the approved operating plan.

## Implementation

Implementation of engineering and geotechnical studies may begin immediately. These studies are of short duration and have very minimal surface disturbance. In addition, these studies will provide engineering data needed to finalize placement of the settling/percolation ponds.

I am delaying construction of the road, adit and settling/percolation ponds for 30 days from the date of this decision. I believe this delay will provide the public with time to raise any concerns that may surface from this decision.

## Consultation with Other Agencies

In conducting the environmental analysis we consulted with the following agencies: Sweet Grass County Commissioners, Sweet Grass County Sheriff's Department, Montana Department of Health and Environmental Sciences, Montana Department of Fish, Wildlife and Parks, Stillwater County Planning Director, U.S. Fish and Wildlife Service and the Custer National Forest.

## Right to Administrative Review

Stillwater PGM Resources may appeal this decision under 36 CFR 228.14. This Decision Notice is subject to appeal by other parties pursuant to 36 CFR 211.18. Notice of appeal must be in writing and submitted to:

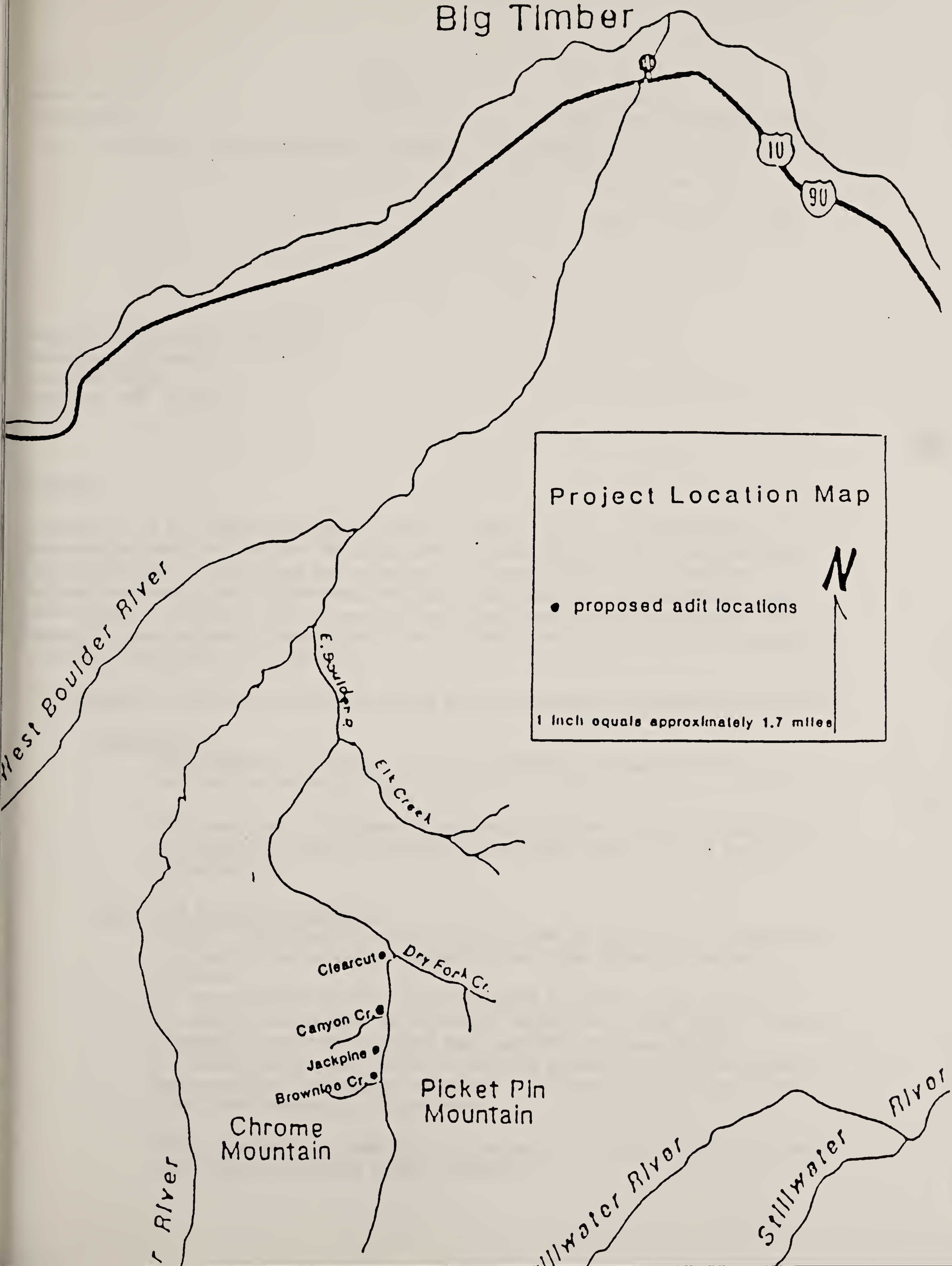
William E. Timko
District Ranger
Big Timber Ranger District
P.O. Box A
Big Timber, MT 59011

Appeal notice under 36 CFR 228.14 and 211.18 must be submitted within 30 days and 45 days, respectively, from the date of this decision. A statement of reasons to support this appeal and any request for oral presentation must be filed within the 30-day period for filing an appeal under 36 CFR 228.14 and within the 45-day period for filing a notice of appeal under 36 CFR 211.18.

William E. Timko

WILLIAM E. TIMKO
District Ranger

1/12/88
Date



Big Timber
10
90
Project Location Map
N
● proposed adit locations
1 inch equals approximately 1.7 miles
West Boulder River
E. Boulder R.
Elk Creek
Dry Fork Cr.
Clearcut
Canyon Cr.
Jackpine
Brownlee Cr.
Picket Pin Mountain
Chrome Mountain
River
Stillwater River
Stillwater River

United States
Department of
Agriculture

Forest
Service

[illegible] Ranger District
P.O. Box A
Big Timber, Montana 59011

Reply To: 1570

Date: April 5, 1988

Greater Yellowstone Coalition
Attention Ed Lewis
P.O. Box 1874
Bozeman, MT 59715

Dear Ed:

Enclosed is a settlement agreement for the appeal of the Jackpine Project Exploration Adit on the East Boulder River.. Additional mitigation measures, data collection, monitoring and studies were identified by the Greater Yellowstone Coalition, Wilderness Society, Stillwater PGM Resources and the Forest Service during negotiations. The Forest Service and Stillwater PGM Resources have agreed to amend the Plan of Operation with the following measures provided the appeal is withdrawn.

The mitigation measures set forth in the Decision Notice are amended as follows:

Reclamation

The company will comply with the approved reclamation plan. A reclamation bond will be required by the agencies.

This measure is included to ensure that the land is reclaimed to comparable utility and stability as that which existed before disturbance.

Soil and Erosion Protection

1. All construction activities will be reviewed by the agencies to insure that adequate measures have been taken to prevent erosion.
2. Stockpiled topsoil will be seeded to reduce wind erosion.
3. Snow removal will be conducted consistent with Forest Service standards (reference timber sale contract clauses C5.46).
4. Road construction will be kept to minimum size and standards necessary to meet safety standards, in order to limit soil and other environmental disturbance.

These measures are provided to reduce soil erosion from wind and water and to address other concerns.

Water Quality

1. The company will implement a water quality monitoring plan designed in cooperation with the state and the Forest Service.
2. The company will obtain all necessary permits related to water quality and water rights as required.
3. Best Management Practices (BMPs) from the "Watershed Management Guidelines for the Gallatin National Forest" dated April, 1987 (also see Gallatin Forest Plan page II - 23) will be implemented where appropriate.
4. A contingency plan for the prevention, detection, control and abatement of petroleum and other hazardous substance spills will be developed and available to company personnel and sub-contractors for the life of this project prior to transport of these materials to the site.

These measures are designed to preclude the degradation of the water quality of the East Boulder River and to maintain the current fishery.

Visuals

1. Existing forest cover will be retained wherever possible to provide visual screening.
2. Facilities will be designed to blend with natural surroundings.

These measures are to decrease visual impacts.

Fire

Operations must comply with the existing fire plan.

This measure is to prevent forest fires.

Fish and Wildlife

1. The company will restrict and monitor access to the project site 24 hours per day. Warning signs will be installed at the end of existing Forest Service Road #205. A locked gate (primarily at night) or security monitoring will be suitable to restrict access.
2. All food on site will be made unavailable to bears, and garbage will be stored in bear-resistant containers, such as those used at Jardine and West Yellowstone, until removed from the area.
3. Snow removal operations on Forest Service Road #205 will be conducted in such a manner that large continuous snow berms/walls do not develop which would impede wildlife movement across the road. Coordination with the Forest Service and Montana Dept. of Fish, Wildlife and Parks is required to identify important crossings and maintain free travel for wildlife.
4. The company will develop an employee transportation program designed to reduce traffic through deer winter range.

5. Any additional pull outs along existing Forest Service Road #205 will be designed to minimize impacts to wildlife, consistent with public safety needs, and will be reviewed by a wildlife biologist.

Measure 1 is to decrease hunting pressure on big game species and to offset the effect of reduced hiding cover and access. In addition, this measure also provides for public safety. The remaining measures are provided to reduce wildlife mortality resulting from conflicts with black bears and wildlife being trapped between the snow berms on the East Boulder Road.

Threatened and Endangered Species

1. Helicopter travel to and from the project area shall be conducted so as not to disrupt peregrine falcons, either newly hacked juveniles or nesting adults. Helicopters and other aircraft will remain at least one mile from the proposed hacking site. However, the greater this distance, the greater is the probability that no disturbances to the birds will occur.
2. Roadside carrion along the East Boulder Road (from the Main Boulder Road to the project) will be removed daily by authorized personnel to prevent mortality of bald eagles during the winter season (November 1 to April 1). Daily checks by designated company representatives will be made in travel to and from the project. In addition, employees and sub-contractors will report collisions with big game animals to the designated company representatives. The company will coordinate with the Montana Department of Fish, Wildlife and Parks to provide for legal removal of animals.
3. The company will continue the policy of not allowing firearms on the project site. The project site will be from the restricted access point to the portal area.
4. To prevent grizzly/human conflicts, strict control of human refuse will be enforced. Forest Service personnel will monitor this condition during routine administration of the project.
5. The company in conjunction with the Forest Service and Montana Department of Fish, Wildlife and Parks will insure that employees involved in the Jackpine Project are educated about the requirements for protection of threatened and endangered species.

These mitigation measures are to limit the possibility of mortality to threatened and endangered wildlife species by avoiding potential conflicts.

Cultural Resources

The company is required to follow the recommendations outlined in the report by Anthro Research, Inc., 1982 for identified sites. Additionally, if previously undiscovered cultural resources are encountered, the operator shall notify the District Ranger and the State Historic Preservation Office.

Although the area has been inventoried and sites identified, the possibility remains that a site may have been missed or is undiscovered; this measure will protect such sites.

Noxious Weeds

The company will be responsible for the control of noxious weeds in the area of operation. This will involve an annual check with a designated Forest Service representative to identify occurrences and determine control measures.

This measure is included to prevent the establishment and spread of noxious weeds resulting from soil disturbance and increased traffic in the area.

Safety

Signs, dust control and possible clearing of vegetation where needed, will be required to improve visibility and reduce hazardous driving conditions. Dust control will also reduce stream sediment, and dust control materials will be chosen that will have minimal effects on water quality and vegetation.

General

1. Any amendments to the plan of operation will be subject to 36 CFR 228.
2. The company will be required to contact the Big Timber District Ranger prior to commencement of ground disturbing activities.
3. Other mitigation measures may be required as project activities proceed. The Forest Service and the Montana Department of State Lands will coordinate with company personnel as necessary.

ıe following data will be collected and monitored in order to assess ₋mpacts of development related activities on wildlife and fish in a joint effort by Montana Department of Fish, Wildlife and Parks, Forest Service and Stillwater PGM Resources. Data collection and monitoring will commence on or before ground breaking takes place for construction of the road and exploratory adit. These studies were identified jointly by the agencies and company listed above by reviewing the BEAK data (1981). Where BEAK studies needed to be updated, supplemented or data was insufficient, additional information will be gathered on wildlife and fish.

Bald Eagles

1. Conduct surveys of eagles during winter months along East Boulder River.
2. Solicit sitings from public.
3. Survey for establishment of nests each Spring along the East Boulder River.

Grizzly Bear

1. Supplement and update BEAK studies with confirmed sitings on the Big Timber District since 1981.
2. Supplement and update BEAK habitat mapping and Grizzly bear use of the East Boulder Area.

Fish

1. Supplement and update BEAK baseline fish population data along the East Boulder River.
2. Identify Rainbow trout spawning areas in East Boulder River and Main Boulder near the mouth of the East Boulder River and determine stream conditions.
3. Supplement and update creel survey on East Boulder River and Main Boulder River for baseline data.
4. Conduct a genetic survey of Cutthroat trout in upper East Boulder River.
5. Monitor for changes in water quality.

Black Bear

1. Add recent Master's thesis data on black bears in the East Boulder River area to data in BEAK.
2. Map black bear habitat and use in the East Boulder River area using information from recent Master's study. Identify travel corridors and key spring and fall concentration areas.

Elk

1. Use FW&P's data from marked and radio collared elk to reanalyze the conclusions reached by BEAK.
2. Conduct seasonal aerial surveys of the East Boulder River and Dry Fork to validate conclusions reached in elk item 1.

Deer

1. Supplement and update deer population and use data in the East Boulder Area, that is, the deer winter range.
2. Conduct seasonal aerial surveys of deer numbers and distribution along the bench south and east of the East Boulder Road.

The terms set forth herein do not change the Forest Service decision to approve the Plan of Operations at the Clear Cut location (Alternate C), and do not make substantial changes in the approval and in the proposed action.

In addition, the Forest Service agrees to the following with the Appellants:

The above studies will also support wildlife and fish baseline data needs for inclusion in any Environmental Impact Statement. In developing the details of these studies, the Forest Service and the Montana Department of Fish, Wildlife & Parks will solicit public input.

The Forest Service agrees to suspend the following projects until an area analysis (RAA) is completed.

Wright-Fuller Timber Sale
Elk Creek Timber Sale
Lower Deer Creek Timber Sale

The RAA will include an analysis of cumulative effects of projects in the East Boulder Area and will include a determination of Management Indicator Species and Species of Special Concern habitat and use.

The Forest Service agrees that proposals made by the company for development of a producing mine may require an Environmental Impact Statement, subject to the provisions of 36 CFR 228 and the Council of Environmental Quality regulations.

If you are in agreement that the statements above will remedy your concerns, please sign below that the appeal is hereby withdrawn and the above agreements will be implemented. If this settlement does not remedy your concerns, then please submit your Statement of Reasons to Forest Supervisor Robert Gibson by April 6, 1988.

Sincerely,

William E Timko

WILLIAM E. TIMKO
District Ranger

Appellant: ______ - Exec. Dir. Date: 4/5/88

GREATER YELLOWSTONE COALITION

cc: Forest Supervisor, Ken Castleton, Scott Spano
Claire Simmons, Louisa Willcox, Charles Eustace

APPENDIX C
REVISED PRELIMINARY DETERMINATION ON
AIR QUALITY PERMIT APPLICATION

AIR QUALITY BUREAU

(406) 444-3454
FAX # (406) 444-1374

January 8, 1992

MEMORANDUM

TO: Interested Persons

FROM: Pat Driscoll, Air Quality Bureau

SUBJECT: East Boulder Project - Revised Preliminary Determination on Air Quality Permit Application

Attached is a copy of the department's revised Preliminary Determination on the air quality permit application for construction and operation of Stillwater PGM Resources' East Boulder Project. The public review and comment period will coincide with the public comment period on the Draft Environmental Impact Statement. The department's final permit decision will be issued within fifteen (15) days after the issuance of the Final Environmental Impact Statement on the project.

The following summarizes the changes which have been made to the original Preliminary Determination issued March 13, 1991.

-- The requirement for a particulate sampler along the access road (Attachment 1) has been deleted. Dust emissions along the access road are one of the most significant air quality issues with respect to this project; however, it was determined that the most effective means to evaluate the situation would be through on-site visual observation. Monitoring could still be required if any specific problem areas are identified through visual observation.

-- Some additional record keeping and reporting requirements have been specified in Section II. L. These also pertain to the road dust issue, specifically chemical stabilization activities and employee bussing.

-- Language has been added to allow for a proposed alternative using twin production adits to access the ore body rather than a single production adit as originally proposed.

If you have any questions or comments, please contact our office.

PD:tl

Enclosure

cc: Jo Stephen, DSL
Mark Story, USFS

AIR QUALITY BUREAU

(406) 444-3454
FAX # (406) 444-1374

REVISED
PRELIMINARY DETERMINATION
ON PERMIT APPLICATION

Date of Mailing: January 8, 1992

Name of Applicant: Stillwater PGM Resources

Source: East Boulder Project - Platinum/Palladium Mine

Proposed Action: The department proposes to issue a permit, with conditions, to the above-named applicant. The application was filed on July 24, 1990 and assigned permit application number 2653.

Proposed Conditions: See attached.

Public Comment: Any member of the public desiring to comment must submit such comments in writing to the bureau at the above address. Comments may address the bureau analysis and determination, and information submitted by the application. In order to be considered, the comments must be received prior to the end of the public comment period on the Draft Environmental Impact Statement. Copies of the application and the bureau's analysis may be inspected at the bureau office in Helena. For more information you may contact the bureau at 444-3454.

Final Action: The bureau intends to make a final decision on the application fifteen (15) days after the Final Environmental Impact Statement is released. A copy of the final action may be obtained at the above address from Pat Driscoll. The permit shall become final fifteen (15) days after issuance of the final decision, unless the department's decision is appealed to the Board of Health and Environmental Sciences.

Procedures for Appeal: Any person jointly or severally adversely affected by the final action may request a hearing before the Montana Board of Health and Environmental Sciences. Any appeal must be filed within fifteen (15) days after the department renders its final decision. The request for hearing shall contain an affidavit setting forth the grounds for the request. Any hearing will be held under the provisions of the Montana Administrative Procedures Act. Submit requests for hearing in triplicate to: Chairman, Board of Health and Environmental Sciences, Cogswell Building, Helena, Montana 59620.

For the department,

Jeffrey T. Chaffee, P.E., Chief
Air Quality Bureau

PD/tl

Air Quality Permit

Issued to: Stillwater PGM Resources
P.O. Box 789
Big Timber, MT 59011

Permit #2653
Date Recd: 7/24/90
Date Preliminary Determination Issued: 3/15/91
Date Revised Preliminary Determination Issued: 1/8/92

SECTION I: Permitted Facilities

An air quality permit is hereby granted to the above-named permittee, hereinafter referred to as recipient, pursuant to Section 75-2-204 and 211, MCA, as amended, and Subchapter 11, PERMIT, CONSTRUCTION AND OPERATION OF AIR CONTAMINANT SOURCES, ARM 16.8.1101 through 16.8.1118 as amended, for the following:

An underground platinum/palladium mining operation and related surface facilities at the East Boulder Project.

SECTION II: Limitations and Conditions

A. Particulate stack emissions are limited to 0.05 grams per dry standard cubic meter from the wet scrubber controlling concentrate dryer emissions. Within 60 days after achieving the maximum production rate, but not later than 180 days after initial start-up, the recipient shall conduct performance tests to verify compliance with this limitation. The test shall include determination of total particulate and PM-10. The test shall be conducted in accordance with the applicable test methods in 40 CFR Part 60, Appendix A, and Subpart LL (total particulate), 40 CFR Part 51 (PM-10), and the Montana Compliance Source Test Protocol. Prior to the commencement of operation, the recipient must submit to the department a description of the concentrate dryer wet scrubber including make, model and design specifications.

B. The recipient shall install, calibrate, maintain, and operate monitoring devices for the continuous measurement of the following on the concentrate dryer wet scrubber:

1. Change in pressure of the gas stream through the scrubber. The monitoring device must be certified by the manufacturer to be accurate within ±250 pascals (±1 inch water) gauge pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions.

2. Scrubbing liquid flow rate to the wet scrubber. The monitoring device must be certified by the manufacturer to be accurate within ±5 percent of design scrubbing liquid flow rate and must be calibrated on at least an annual basis in accordance with manufacturer's instructions.

The recipient shall record the measurements of both the pressure drop across the scrubber and the scrubbing liquid flow rate during the initial performance test of the scrubber and at least weekly thereafter. The recipient shall submit semiannual reports to the department of occurrences when the measurements of the scrubber pressure loss (or gain) and liquid flow rate differ by more than ±30 percent from those measurements recorded during the most recent performance test. These reports must be submitted within 30 days following the end of the second and fourth calendar quarters and may be combined with the quarterly reports required in the Monitoring Plan (Attachment 1).

C. Process fugitive emissions are subject to an opacity limitation of ten percent (10%). Other fugitive emissions are limited to 20 percent opacity.

D. The recipient shall furnish the department the following notification:

1. Date construction is commenced postmarked no later than 30 days after such date.

2. Anticipated date of initial start-up postmarked not more than 60 days nor less than 30 days prior to such date.

3. Actual date of initial start-up postmarked within 15 days after such date.

E. The recipient shall provide the department at least 30 days prior notice of the date of any performance test in order to allow an observer to be present.

F. Compliance with emission and opacity standards and testing requirements shall be as specified in 40 CFR Part 60, where applicable.

G. The recipient shall operate an ambient air quality monitoring network as described in Attachment 1 of this permit. The monitoring plan will be periodically reviewed by the department and revised if necessary.

H. Nitrogen oxides (NOx) emissions from electrical generation shall be limited to 65 tons per year. This limitation shall be verified through manufacturer information on the generator(s) or by performance testing of the actual generator(s) to be used. Records of the generator(s) operating hours, loads, and fuel usage shall be maintained on-site. Prior to the commencement of operation, the recipient must submit to the department a description of the electrical generation system to be used including any emissions data available.

I. The recipient must take appropriate precautions to minimize fugitive dust with respect to all construction and operation activities related to the project. This would include water and/or chemical stabilization of roads and work areas on an as-necessary basis and adequate control of any process or material handling operations. With respect to the mine access road, the recipient must work in consultation and coordination with Sweet Grass County and the U.S. Forest Service to minimize particulate emissions from their respective portions of the road.

J. Maximum ore production shall be limited to 2500 tons per day and 730,000 tons per year. Maximum waste production shall be limited to 350,000 tons per year. Any proposed increase above these levels would require a permit alteration because these numbers were used in developing the emission inventory and dispersion modeling for the project.

K. The recipient shall comply with all other applicable state, federal and local regulations.

L. The recipient shall maintain on-site and supply the department on an annual basis, specific operational data. This information may be included with the annual report required in the Ambient Air Monitoring Plan (Attachment 1) and shall include the following:

1. The amount of ore and waste handled (annual basis and the maximum daily amount),

2. A summary of dust control activities including types and amounts of chemical stabilizers used, application areas, and general watering schedules where applicable (the summary should include dust suppression activities on the U.S. Forest Service and county portions of the access road),

3. The status of employee bussing, and

4. Any other information related to air pollutant emissions the department may request.

SECTION III: General

A. Inspection - The recipient shall allow the department's representatives access to the source at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data, auditing any monitoring equipment (CEMS, CERMS) or observing any monitoring or testing, and otherwise conducting all necessary functions related to this permit.

B. Waiver - The permit and all the terms, conditions, and matters stated herein shall be deemed accepted if the recipient fails to appeal as indicated below.

C. Compliance with Statutes and Regulations - Specific listing of requirements, limitations, and conditions contained herein does not relieve the applicant from compliance with all applicable statutes and administrative regulations including amendments thereto, nor waive the right of the department to require compliance with all applicable statutes and administrative regulations, including amendments thereto.

D. Enforcement - Violations of limitations, conditions and requirements contained herein may constitute grounds for permit revocation, penalties or other enforcement as specified in Section 75-2-401 et seq., MCA.

E. Appeals - Any person or persons who are jointly or severally adversely affected by the department's decision may request, within fifteen (15) days after the department renders its decision, upon affidavit, setting forth the grounds therefore, a hearing before the Board. A hearing shall be held under the provisions of the Montana Administrative Procedures Act. The department's decision on the application is not final unless fifteen (15) days have elapsed and there is no request for a hearing under this section. The filing of a request for a hearing postpones the effective date of the department's decision until the conclusion of the hearing and issuance of a final decision by the Board.

F. Application Data - Information submitted on behalf of an air quality permit application is hereby incorporated as a condition of that permit including commencement and completion dates of construction.

G. Permit Inspection - As required by ARM 16.8.1115 Inspection of Permit, a copy of the air quality permit shall be made available for inspection by air quality personnel at the location of the permitted source.

H. Permit Fees - Pursuant to Section 75-2-211, MCA, as amended by the 1991 Legislature, the continuing validity of this permit is conditional upon the payment by the permittee of an annual operation fee, as required by that Section and rules adopted thereunder by the Board of Health and Environmental Sciences.

Permit Application Analysis
East Boulder Project - Stillwater PGM Resources
Application #2653

## I. Introduction

Stillwater PGM Resources (SPGMR) has applied for an air quality permit for an underground platinum/palladium mining operation and ore processing facilities referred to as the East Boulder Project. The application was submitted on July 24, 1990. Some revisions to the application were submitted on February 4, 1991. The project area is located about 30 miles south of Big Timber in Sweet Grass County.

## II. Project Description

The East Boulder operation would consist of an underground mine, an ore processing mill, a surface mine/mill support complex, a tailings retention impoundment, and other secondary facilities required to support the operation. The majority of the surface facilities would be located adjacent to the mine access adit in the East Boulder valley on SPGMR mill site claims. Other surface construction would be located on SPGMR patented or mineral lode claims.

The proposed permit area would encompass a total of approximately 844 acres in three separate locations. The total area of disturbance within the permit area would be approximately 233 acres.

Under the current proposal, the mine ore production rate would be a maximum of 730,000 tons of ore per year. The life of the operation would ultimately be determined by the economic viability of the operation which is a function of metal prices, ore grade, continuity of the ore zone, and the costs of production. At the present time, an operating life in excess of 25 years is anticipated.

All ore and waste rock produced from the mine would be transported to the surface via the primary mine entry facility, the East Boulder adit. (Under the original proposal, a single production adit from the plant site would be used with an exhaust ventilation adit at Brownlee Creek. A possible alternative is to use twin adits from the plant site, eliminating the Brownlee Creek adit.) The ore would be conveyed to a semi-autogenous (SAG) mill for grinding (wet process) followed by concentration in a flotation mill located adjacent to the adit. This mill would produce a flotation concentrate in the ratio of approximately one ton of concentrate for each 100 tons of ore processed. The concentrate would be shipped from the project site by truck for further processing in the Stillwater Mining Company (SMC) smelter at Columbus.

Tailings from the mill would be disposed in a lined tailings impoundment located immediately north and west of the mill complex. The tailings impoundment would be designed to retain approximately 40 percent of the total volume of tailings. The remaining 60 percent would be returned underground for use as backfill in the stope mining process. The tailings impoundment would be constructed from mine waste rock and borrow materials excavated from the interior of the pond area, and would ultimately occupy approximately 105 acres of land area.

Mine waste rock would also be used as a fill material in underground mined-out stopes or for miscellaneous construction purposes throughout the project. Surplus waste rock would be used in reclamation or disposed in waste rock storage piles.

The proposed operation would employ approximately 600 workers during steady state operating conditions. A substantial number of workers are expected to be drawn from the local labor force.

A rigorous program of environmental monitoring and disturbed area reclamation would be initiated at the start of construction and would be continued throughout the life of the operation. Major facility sites (e.g., tailings area, mill/mine support facilities) would be reclaimed following mine closure. In most cases, reclamation programs would be directed toward revegetating disturbed areas to allow re-use of such areas for recreation, wildlife habitat, and land uses that existed prior to project development.

Exploration activities in the Frog Pond area and along the Beartooth Plateau in the vicinity of the proposed project area have revealed many similarities to the section of the J-M Reef now being mined by SMC at the Stillwater Mine. Because of the similarities in ore and waste mineralogy, mine conditions, facility requirements, mining and milling methodologies, and SMC's experience in operating within sensitive environmental settings, the proposed East Boulder operation has been closely patterned after SMC, thus incorporating similar operating technology in the East Boulder design.

Power for the initial phase of the project prior to completion of a power line to the site would be provided by an on-site electrical generation system. Approximately 3.5 megawatts of power would be required. The specific type of generator(s) has not been determined yet. It could be propane-fired or diesel-fired with add-on emission controls or possibly a combination of generators. The limiting factor is NOx emissions from the system and the ability to comply with the Class II Prevention of Significant Deterioration (PSD) $NO_2$ increment. Based on dispersion modeling results, a total of 65 tons per year of NOx emissions from the generator(s), in conjunction with the other project-related NOx emissions, would be allowable.

A complete description of the project is included in the application.

## III. Applicable Regulations

SPGMR is required under ARM Title 16, Chapter 8, Subchapter 11, <u>PERMIT, CONSTRUCTION AND OPERATION OF AIR CONTAMINANT SOURCES</u>, to obtain an air quality permit. This subchapter also requires the utilization of Best Available Control Technology (BACT).

Federal Standards of Performance for New Stationary Sources (NSPS) for Metallic Mineral Processing Plants (40 CFR Part 60, Subpart LL) and ARM 16.8.1423 are also applicable to this project. This regulation sets a particulate emission limitation on stack emissions of 0.05 grams per dry standard cubic meter (0.02 grains per dry standard cubic foot) and requires monitoring devices for the continuous measurement of pressure drop through the concentrate dryer wet scrubber and for scrubbing liquid flow rate to the wet scrubber. (This regulation does not apply to underground equipment.) Process fugitive emissions (those emissions that are not collected by a capture system such as a hood or enclosure) are limited to ten percent opacity.

The following is a listing of other applicable parts of the Montana Air Quality Rules:

ARM 16.8.1401 PARTICULATE MATTER, AIRBORNE
ARM 16.8.1402 PARTICULATE MATTER, FUEL BURNING EQUIPMENT
ARM 16.8.1403 PARTICULATE MATTER, INDUSTRIAL PROCESSES
ARM 16.8.1404 VISIBLE AIR CONTAMINANTS
ARM 16.8.1411 SULFUR OXIDE EMISSIONS - SULFUR-IN-FUEL
ARM 16.8.805-16.8.822 AMBIENT AIR QUALITY STANDARDS

Prevention of Significant Deterioration (PSD) permit requirements (ARM 16.8.921 through 16.8.943) are not applicable because estimated emissions of any pollutant are less than 250 tons per year. Although the PSD regulations are not directly applicable, a demonstration (computer modeling) was required to verify compliance with the PSD nitrogen dioxide ($NO_2$) increment.

With respect to maximum allowable increases (PSD increments), only $NO_2$ and sulfur dioxide ($SO_2$) emissions from this project would consume increment because the baseline is triggered for these two pollutants, but it is not for particulate. This difference is due to the fact that, under the Montana PSD regulation, particulate baseline areas are defined as the impact areas of major sources, while the baseline area is defined as the entire state for $SO_2$ and $NO_2$. There are no particulate baseline areas which would be impacted by this project; therefore, there would be no increment consumption (particulate increases would become part of the baseline). $SO_2$ increment consumption would be minimal given the small amount of $SO_2$ emissions. $NO_2$ increment consumption is addressed in Section VI.

## IV. Existing Air Quality

Baseline air quality (particulate) has been monitored in the area during two periods. The first was during portions of 1981 and 1982 and the second was during portions of 1988 and 1989. All values are well below applicable ambient air quality standards. The following table summarizes the data.

Summary of Suspended Particulate Data
East Boulder Project, Big Timber, Montana
(values in micrograms per cubic meter - $\mu g/m3$)

| Site | Maximum | Second High | Arithmetic Mean | No. of Samples |
|---|---|---|---|---|
| PM-10 Suspended Particulates - 1988-89 | | | | |
| 1 | 35 | 28 | 9 | 43 |
| Total Suspended Particulates - 1981-82 | | | | |
| Main | 54 | 45 | 13 | 43 |

*The state and federal PM-10 (particulate matter less than 10 microns) standards are as follows:

Annual average = 50 $\mu g/m^3$
24-hour = 150 $\mu g/m^3$

The PM-10 samples were also analyzed for a number of trace elements selected by the department (arsenic, cadmium, chromium, copper and lead). There is an ambient air quality standard for lead. The other elements are compared against guideline values set by the department. All trace element concentrations were well below the standards or guideline values.

The meteorological data collected during 1988-89 is presented in the application in the form of a frequency table and wind rose. The predominant wind directions for this time period were from the south and west. The meteorological data collected in 1981-82 was actually the data that was input into the dispersion model. The predominant wind directions from this data set were from the southeast and west through northwest.

The project area is classified as a Class II area under the Prevention of Significant Deterioration (PSD) regulations. This includes the Absaroka-Beartooth Wilderness area to the south. The nearest PSD Class I area is the Yellowstone National Park, approximately 15 miles south of the project area. In the immediate project area there are no significant sources for air contaminants. Local sources for air pollutants include slash burning and unpaved roads. At further distances, sources for air contaminants would include the Stillwater Mine near Nye, home heating, and agricultural operations.

V. Emission Inventory and Control Technology Review

Table 1 lists the estimated total particulate emissions for the project, including the emission control practices and equipment to be used. The application also contains a listing of PM-10 emission estimates.

TABLE 1

East Boulder Project

Total Particulate Emissions - Worst Case Annual Period

| Activity | Uncontrolled Emissions Ton/Yr | Control Measures | Percent | Controlled Emissions Ton/Yr |
|---|---|---|---|---|
| Topsoil Stockpiles | 0.37 | Revegetation | 75 | 0.09 |
| Disturbed Areas | 9.32 | None | 0 | 9.32 |
| Coarse Ore Stkpile | 0.03 | None | 0 | 0.03 |
| Mine Ventilation Exhaust | 22.53 | None | 0 | 22.53 |
| Dumping Coarse Ore into Stockpile or Storage Bin | 3.65 | Minimize Fall Distance | 0 | 3.65 |
| Ore Apron Feeder to SAG Mill | 3.65 | Minimize Fall Distance | 0 | 3.65 |
| Dumping Waste Rock | 1.38 | Minimize Fall Distance | 0 | 1.38 |
| Load, Haul, Dump, Spread Waste on Tailings Embank. | 21.01 | Minimize Fall Distance/Watering | 0<br>50 | 12.56 |
| Haul Roads - Mine Area | 46.90 | Chemical Stabilizer/ Watering as Necessary | 85 | 7.04 |
| Concentrate Dryer | 2.10 | Wet Scrubber | * | 2.10 |
| Service, Small Vehicle Traffic on Unpaved Roads | 3.55 | Chemical Stabilizer/ Watering as Necessary | 85 | 0.53 |
| Diesel Exhaust (Surface) | 0.92 | Operation | 0 | 0.92 |
| | 115.41 | | | 63.80 |

*Uncontrolled emissions for concentrate dryer are actually controlled emissions.

NOTE: The primary emission point for underground emissions would be at the Brownlee Creek adit located about three miles south of the plant site, under the original proposal. Under the twin adit proposal, the ventilation emission point would be at the plant site.

Table 2 lists the estimated gaseous emissions for the project.

TABLE 2

Gaseous Pollutant Emissions

| Activity | Sulfur Dioxide tpy | Carbon Monoxide tpy | Nitrogen Oxides tpy |
|---|---|---|---|
| Explosive | --- | 12 | --- |
| Vehicle Exhaust | 4 | 22 | 52 |
| Generator | 57 | 131 | 65 |
| | 61 | 165 | 117 |

NOTE: Emission estimates for electrical generation are based on the permitted allowable for NOx and diesel exhaust emission factors (AP-42, Section 3.4) at maximum production for carbon monoxide and sulfur dioxide.

The emission control measures for particulate and the gaseous pollutant limitations shown above have been deemed to represent BACT for this project.

A significant concern with this operation is the potential for particulate emissions along the unpaved portion of the access road from Highway 298 to the mine site. This is with respect to the increased traffic associated with the operation such as employee and service traffic. On a public road, the governmental entity authorizing the use of the road has primary authority over its maintenance, while a company using the road extensively would have more of an indirect responsibility. Sweet Grass County controls part of the road as does the U.S. Forest Service. This permit requires, as a condition of operation, that adequate dust control be maintained. The department's intent is that the company work with the county, the U.S. Forest Service, and concerned members of the public to implement the most reasonable dust control measures.

SPGMR will follow Best Management Practices of the Gallatin National Forest which address dust control. They have also proposed bussing to minimize the number of vehicles on the road. Chemical stabilization or paving of key portions of the road, such as near residences, may be necessary. The agencies would review the adequacy of dust control on an ongoing basis through the life of the operation. The primary means to evaluate the adequacy of dust control will be through visual observation. Particulate air sampling could be required at a later time if a specific need is identified.

Another concern with many hard rock mining operations is the potential for wind erosion of tailings. The proposed design and operation of this tailings facility is very similar to the SMC tailings impoundment. There have been no identified problems with respect to wind erosion of tailings at SMC. The main reason for this is in maintaining a water level which allows very little exposed tailings beach areas. Given this type of operation, there should not be a problem with SPGMR's tailings impoundment. The company does retain the responsibility to control wind erosion in the event of an unforeseen situation such as a temporary curtailment of the operation. This also applies to the period of time between the end of active operations and final reclamation of the site.

There would be some secondary air quality impacts from the project on the Boulder River Valley and Big Timber due to population growth related to the project and the resulting potential for increased vehicle traffic/road dust and residential wood burning. Current air quality in the area is good and these secondary impacts should not have a significant effect.

## VI. Impact Analyses

SPGMR ran the EPA Valley model to determine air quality impacts from the proposed underground mine, mill and tailings disposal facility. For the annual concentration, they used a STAR deck generated from the wind data collected in 1981-82. For the 24-hour concentration, they used EPA worst-case default meteorology of 2.5 m/sec, F-stability and six hours of occurrence.

For particulate modeling, SPGMR used annual average emission estimates for the annual impact and the maximum worst-case 24-hour emission estimates for the short-term (24-hour) impact. The results of the PM-10 modeling are presented in Table 3.

TABLE 3

PM-10 Modeling Results
(micrograms per cubic meter)

| Time Period | Max. Conc. | Background | Max. Conc. plus Bkgd. | Standard |
|---|---|---|---|---|
| Annual | 9.4 | 9.0 | 18.4 | 50 |
| 24-hour | 16.5 | 35.0 | 51.5 | 150 |

The particulate modeling analysis was performed based on the original single adit proposal. Mine ventilation particulate emissions were modeled from the Brownlee Creek adit while other emissions were at the plant site. Under the twin adit proposal, all emissions would be in the plant site area. Additional modeling was not required because this was not considered a significant change.

For nitrogen dioxide ($NO_2$) modeling, SPGMR used an annual emission estimate for oxides of nitrogen (NOx) to predict an annual $NO_2$ concentration. The primary source would be the electrical generator (maximum NOx of 65 T/yr) with smaller amounts of NOx from diesel exhaust from the mine. SPGMR assumed that all NOx would be converted to $NO_2$. This is a conservative assumption since the reaction is dependent upon an oxidant being available. The predicted annual impact is used to compare with the allowable PSD Class II increment.

SPGMR did not model for 1-hour $NO_2$. Due to the relatively low amount of NOx, the department does not feel that the 1-hour Montana standard will be exceeded. The results of the NOx modeling are presented in Table 4.

TABLE 4

$NO_2$ Modeling Results
(micrograms per cubic meter)

| Time Period | Max. Conc. | PSD Class II Increment |
|---|---|---|
| Annual | 24.1 | 25 |

SPGMR predicted visibility impairment due to the proposed facility using a method that is described in the Workbook for Estimating Visibility Impairment. The Level 1 screening analysis showed that the project would not cause adverse visibility impairment to the Absaroka-Beartooth Wilderness. The U.S. Forest Service also performed a visibility analysis using the VISCREEN model. This model is referenced in the Workbook for Plume Visual Impact Screening and Analysis. The Forest Service's analysis also showed that the project would not cause adverse visibility impairment. These analyses were done based on the original proposal (propane-fired) for electrical generation. Given the relatively small increase in NOx emissions, it is assumed that the conclusion is still valid.

A Draft Environmental Impact Statement (DEIS) has been prepared on the project. The comment period on this Preliminary Determination will coincide with the comment period on the DEIS. The department will issue a final decision on the air quality permit application within 15 days after issuance of the Final EIS on the project.

Attachment 1

AMBIENT AIR MONITORING PLAN
STILLWATER PGM RESOURCES
Permit #2653

1. This ambient air monitoring plan is required by air quality permit #2653 which applies to the Stillwater PGM Resources (SPGMR) platinum/palladium mining operation south of Big Timber. This monitoring plan may be modified by the department. All requirements of this plan are considered conditions of the permit.

2. SPGMR shall install, operate and maintain three air monitoring sites in the vicinity of the mine and facilities. The exact locations of the monitoring sites must be approved by the department and meet all the siting requirements contained in the Montana Quality Assurance Manual including revisions, the EPA Quality Assurance Manual including revisions, and Parts 53 and 58 of the Code of Federal Regulations, or any other requirements specified by the department.

3. SPGMR shall commence air monitoring at the commencement of construction and continue for at least one year after normal production is achieved. The air monitoring data will be reviewed by the department and the department will determine if continued monitoring or additional monitoring is warranted. The department may require continued air monitoring to track long-term impacts of emissions from the facility or require additional ambient air monitoring or analyses if any changes take place in regard to quality and/or quantity of emissions or the area of impact from the emissions.

4. SPGMR shall monitor the following parameters at the sites and frequencies described below:

| Location | Site # | Parameter | Frequency |
|---|---|---|---|
| Plant Area (Up-drainage) | Site #1 | PM-10[1] | Every third day |
| Plant Area (Down-drainage) | Site #2 | PM-10 (Collocated[2])<br>Wind Speed, Direction and Sigma Theta | Every third day<br>Continuous |

[1] PM-10 = particulate matter less than 10 microns.
[2] The requirement for a collocated PM-10 sampler may be waived if the monitor operator operates a collocated PM-10 sampler at another site.

- Trace element analyses shall be performed on every third filter from each site, including lead, cadmium, arsenic, zinc and chromium. The number of elements and frequency of analysis will be reviewed on an ongoing basis.

- Data recovery for all parameters shall be at least 80 percent computed on a quarterly and annual basis. The department may require continued monitoring if this condition is not met.

5. Any ambient air monitoring changes proposed by SPGMR must be approved in writing by the department.

6. SPGMR shall utilize air monitoring and quality assurance procedures which are equal to or exceed the requirements described in the Montana Quality Assurance Manual including revisions, the EPA Quality Assurance Manual including revisions, 40 CFR Parts 53 and 58 of the Code of Federal Regulations, and any other requirements specified by the department.

7. SPGMR shall submit quarterly data reports within 45 days after the end of the calendar quarter and an annual data report within 90 days after the end of the calendar year. The annual report may be substituted for the fourth quarterly report if all information in 8. below is included in the report.

8. The quarterly report shall consist of a narrative data summary and a data submittal of all data points on AIRS formatted paper input forms, punch cards, disks or magnetic tapes which are compatible with the department's computer system. The narrative data summary shall include:

   a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities and the general area;

   b. A hard copy of the individual data points;

   c. The quarterly and monthly means for PM-10 and wind speed;

   d. The first and second highest 24-hour concentrations for PM-10;

   e. The quarterly and monthly wind roses;

   f. A summary of the data collection efficiency;

   g. A summary of the reasons for missing data;

   h. A precision and accuracy (audit) summary;

   i. A summary of any ambient air standard exceedances; and

   j. Calibration information.

9. The annual data report shall consist of a narrative data summary containing:

   a. A topographic map of appropriate scale with UTM coordinates and a true north arrow showing the air monitoring site locations in relation to the mine and facilities and the general area;

   b. A pollution trend analysis;

   c. The annual means for PM-10 and wind speed;

   d. The first and second highest 24-hour concentrations for PM-10;

   e. The annual wind rose;

   f. An annual summary of data collection efficiency;

   g. An annual summary of precision and accuracy (audit) data;

h. An annual summary of any ambient standard exceedance; and

i. Recommendations for future monitoring.

10. The department may audit, or may require SPGMR to contract with an independent firm to audit, the air monitoring network, the laboratory performing associated analyses, and any data handling procedures at unspecified times. On the basis of the audits and subsequent reports, the department may recommend or require changes in the air monitoring network and associated activities in order to improve precision, accuracy and data completeness.

| Section | | Page |
|---|---|---|
| 1.0 | INTRODUCTION | 2 |
| 2.0 | PROJECT LOCATION AND DESCRIPTION | 3 |
| 3.0 | LISTED THREATENED OR ENDANGERED SPECIES | 8 |
| 3.1 | BALD EAGLE | 8 |
| 3.2 | PEREGRINE FALCON | 11 |
| 3.3 | GRIZZLY BEAR | 14 |
| 3.4 | DETERMINATION OF EFFECT | 17 |
| 4.0 | SENSITIVE SPECIES | 18 |
| 4.1 | SENSITIVE SPECIES KNOWN OR LIKELY TO OCCUR IN THE PROJECT AREA | 18 |
| 4.2 | SENSITIVE SPECIES NOT FOUND IN THE PROJECT AREA | 20 |
| 5.0 | INDIVIDUALS CONTACTED AND LITERATURE CITED | 24 |
| 5.1 | INDIVIDUALS CONTACTED | 24 |
| 5.2 | LITERATURE CITED | 24 |
| 6.0 | ENDANGERED SPECIES COMPLIANCE LETTERS | 27 |


LIST OF FIGURES


| | | |
|---|---|---|
| FIGURE 2-1 | VICINITY MAP | 4 |
| FIGURE 2-2 | PROJECT AREA | 5 |

# 1.0 INTRODUCTION

This Biological Assessment has been prepared as part of Endangered Species Act compliance by the Gallatin National Forest (GNF), for the proposed Stillwater PGM Resources (SPGMR) East Boulder Mine Project. Potential impacts resulting from the proposed project to endangered, threatened, and sensitive species are evaluated below. The federally listed species included are the three species identified as potentially present by the Helena Office of the U.S. Fish and Wildlife Service, in their letters of September 24, 1990 and January 16, 1991 (Section 6.0). These are the threatened grizzly bear (Ursus arctos horribilis), and the endangered bald eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrinus anatum). No evaluation of candidate species is included based on U.S. Fish and Wildlife Service policy which requires only inclusion of Category 1 species, and none are known to occur in the Gallatin National Forest (January 30, 1991, letter, Section 6). In accordance with Forest Service policy, this Biological Assessment does include evaluations of all Forest Service sensitive species known or potentially occurring in the region.

The information and analysis in this document have been primarily obtained from previous published and unpublished reports and documents, and contacts with resource and various federal and state agency personnel. A large amount of biological information has been previously developed for the study area, including reports on endangered, threatened, and sensitive species studied by Beak (1982), the Biological Assessment for the Jackpine Project (USDA FS 1987a), supplemental information prepared by Weston et al. (1989), and grizzly bear habitat mapping by OEA Resources (1990).

## 2.0
## PROJECT LOCATION AND DESCRIPTION

The East Boulder Mine Project consists of an underground platinum/palladium mine and associated milling facilities located in the East Boulder River drainage approximately 30 miles south of the town of Big Timber, Montana (see Figure 2-1), within the boundaries of the Gallatin National Forest. The surrounding area is mountainous, relatively sparsely populated, and noted for its scenic beauty and recreational opportunities. Designated wilderness areas are located nearby, and Yellowstone National Park is approximately 30 air miles to the south. Elevations in the project area range from under 6,500 feet along the East Boulder River to 9,600 feet on the East Boulder Plateau. Vegetation consists of heavily timbered areas with dense stands of lodgepole pine to alpine meadows on the East Boulder Plateau. The East Boulder River has its headwaters in the northern edge of the Beartooth Mountains and flows northerly into the Main Boulder River near McLeod, Montana. The Main Boulder River eventually joins the Yellowstone River near Big Timber.

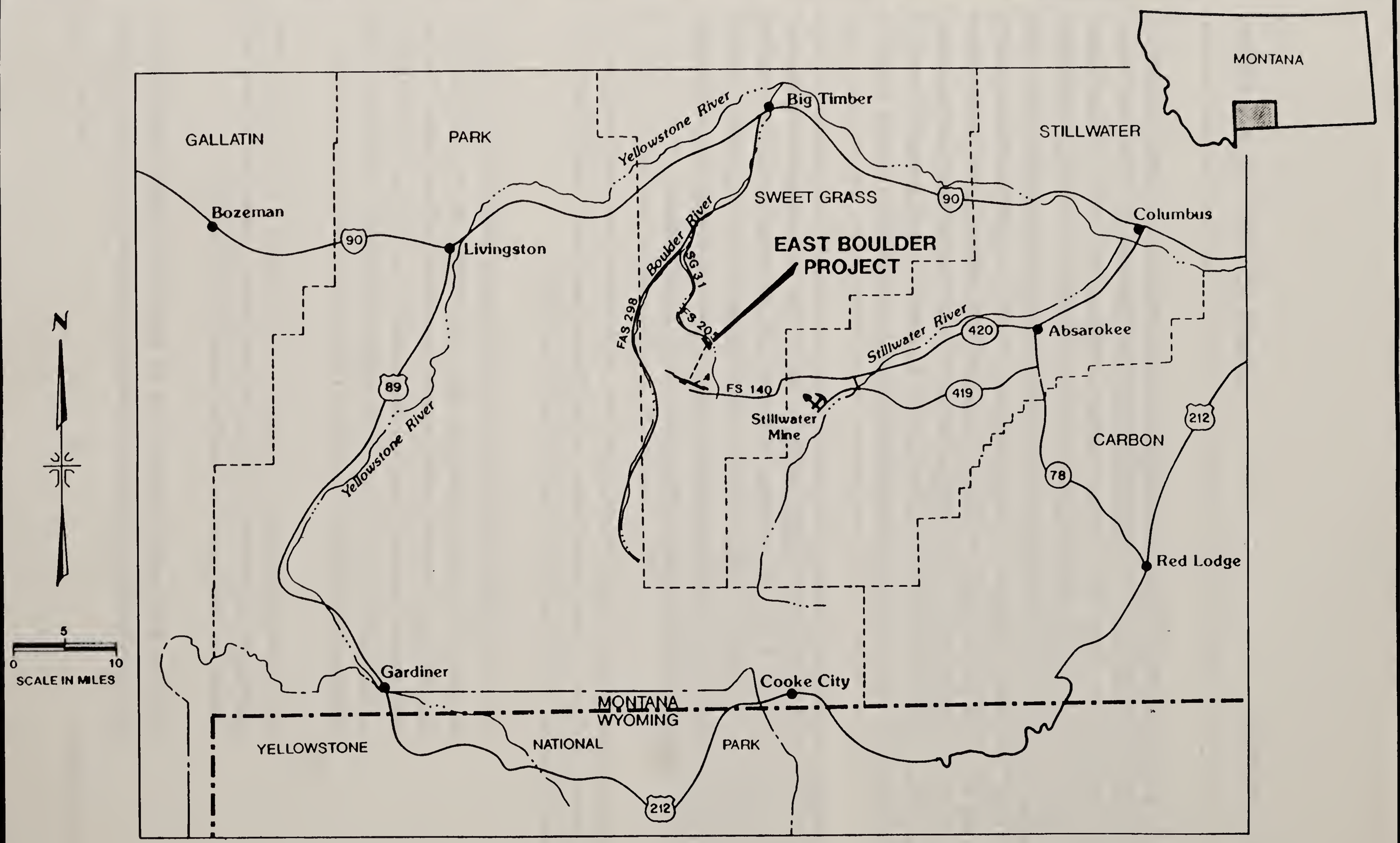
An exploration adit and related facilities have been previously approved by GNF, and preliminary work has begun on the exploration project, including clearing of timber near the exploration adit, and road development. The project being evaluated includes full development of the mine and mill. This would be the second mine in the Stillwater Complex, and would be very similar to the operating Stillwater Mine at Nye, Montana. The annual production rate would be 730,000 tons of ore over an expected operation lifetime of 27 years. The mine and mill complex would employ 600 people at full operation.

The proposed project area would total 844 acres, located within three separate permit areas (see Figure 2-2). Approximately 233 acres, located primarily within the East Boulder permit area, would be disturbed or occupied by facilities. A brief description of the three permit areas follows:

- Most of the facilities would be located in the East Boulder permit area, on SPGMR mill site claims. The facilities include the main mine entrance, an ore processing mill, a mine/mill support complex, a tailing retention impoundment, and other facilities. The East Boulder permit area would occupy 260 acres, of which about 200 acres would be disturbed, including approximately 105 acres for the tailing impoundment. About 30 acres of this disturbance has already been permitted by GNF as the Jackpine Exploration Project.

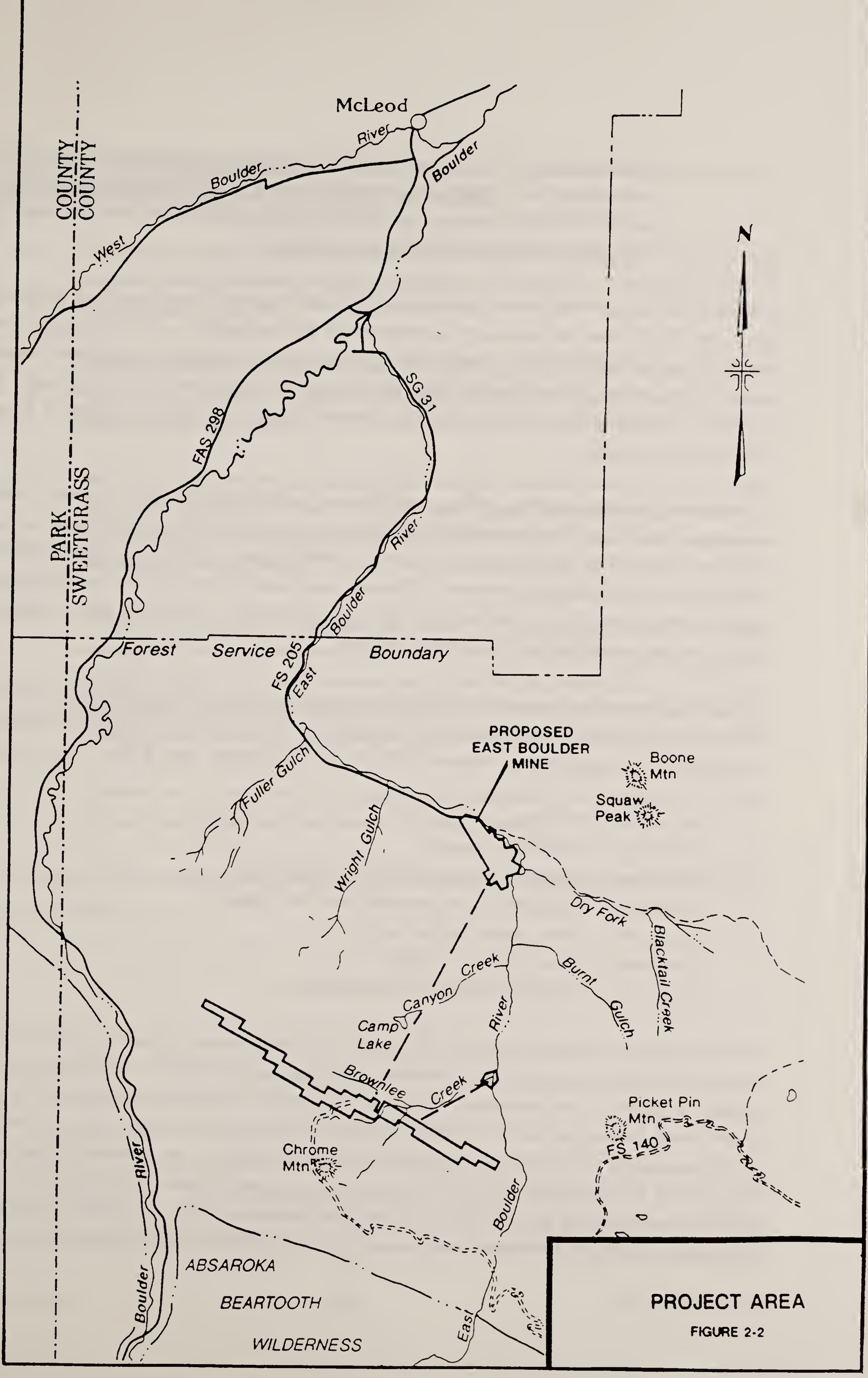
- The Brownlee Creek permit area, located on SPGMR patented or mineral lode claims, would include the Brownlee Creek adit, and would occupy 4 acres of which 3 acres would be disturbed. This permit area would be accessed by helicopter only.

- The Placer Basin permit area, located on the East Boulder Plateau, would occupy 580 acres, of which about 30 acres would be disturbed during the life of the mine. Facilities




**VICINITY MAP**

**FIGURE 2-1**




PROJECT AREA

FIGURE 2-2

within the Placer Basin permit area would be located on patented and mineral lode claims and include 5 adits, 1 shaft, and 3 ventilation raises. Surface facilities would be minimal, and would include fencing around the shafts, small buildings at four locations, a small waste rock dump, adit yards, and minor road upgrading.

In addition, the project would involve upgrading approximately 26 miles of the existing East Boulder Road (SG 31 and FS 205) from its origin near the confluence of the East Boulder and Main Boulder Rivers, to the mine site at the end of FS 205. Approximately 2.6 miles of new road would be constructed around the mine site. The existing transmission line along the East Boulder Road would also be upgraded. Minor upgrades to the existing FS 140 road on the East Boulder Plateau would also be required to access the Placer Basin permit area.

A conventional crushing, grinding, milling, and flotation process would be used to obtain a flotation concentrate from the ore. The concentrate would be shipped from the site by truck for further processing. The coarse fraction of the mill tailing would be used as a backfill in the mining process; the remainder would be deposited in a lined tailing impoundment. Mine waste rock would be used for a variety of purposes: the majority would be used for the construction of the tailing impoundment, with other uses to include road surfacing, erosion protection, and final site reclamation.

The agencies responsible for permitting SPGMR's proposed project include the Gallatin National Forest (GNF) and the Montana Department of State Lands (DSL). These agencies evaluated seven alternatives in the draft Environmental Impact Statement (EIS) for the East Boulder Mine Project. These include:

Alternative 1 - No action
Alternative 2 - SPGMR's proposal
Alternative 3 - Modified tailing impoundment configuration
Alternative 4 - Alternative access road and power line alignment
Alternative 5 - Power supply corridor systems
Alternative 6 - Water treatment options
Alternative 7 - SPGMR's proposal with modifications.

In the draft EIS the agencies identified Alternative 7 as their preferred alternative, and this biological assessment is based on the preferred alternative. The Montana Department of State Lands has not yet identified a preferred road alternative. The preferred alternative includes upgrading the existing East Boulder Road, but does not include a preferred powerline route from the Duck Creek tap to the existing 161 kV transmission line north of the Yellowstone River, nor a preferred water treatment alternative which will be chosen by the Montana Board of Health and Environmental Sciences. The preferred alternative includes an understanding that SPGMR will abide by the conservation measures set forth in the Jackpine Environmental Assessment Decision Notice, as amended, and will follow Best Management Practices of the

GNF. Other conservation measures identified in the draft EIS under the preferred alternative related to the protection of endangered, threatened, or sensitive species include:

- Disturbed areas near roads must be seeded with unpalatable plant species to help reduce road kills and the potential for eagles to forage on the access route. The plant species will be coordinated with GNF.

- SPGMR will contact both local GNF and Montana Department of Fish, Wildlife, and Parks biologists to coordinate construction activities schedules in order to minimize wildlife impact during critical times.

- Helicopter flights will avoid low-level flight in winter along bald eagle feeding/roosting areas of the East Boulder River. These areas and peregrine falcon avoidance areas will be clearly identified in coordination with GNF and MDFWP biologists to ensure pilots and employees are fully informed.

- Additional information concerning the fence to be installed around the tailing impoundment must be provided to allow GNF and DSL to evaluate its ability to prevent wildlife intrusion. It should be noted that if wildlife, particularly birds, do enter the impoundment area, the water in the tailing impoundment is expected to meet drinking water standards (except for suspended solids) and would not be harmful to wildlife.

- Minimum historic low flows of 5 cubic feet per second must be maintained in the East Boulder River during the project period to protect fisheries.

Should the agencies select another alternative in the final EIS for this project, this Biological Assessment may have to be amended.

## 3.1 BALD EAGLE

Status

The bald eagle (Haliaeetus leucocephalus) is listed as endangered by the U.S. Fish and Wildlife Service for the populations in the continental United States, except for populations in Washington, Oregon, Minnesota, Wisconsin, and Michigan, which are listed as threatened. The bald eagle is also listed as endangered by the State of Montana. The Montana population is currently recovering and is being considered for down-listing by the U.S. Fish and Wildlife Service.

Distribution and Habitat

Bald eagles occur throughout North America, principally near coasts, rivers, and large bodies of water. A northern population breeds across the northern half of the United States to northern Canada and Alaska, while a southern population breeds in the southern half of the United States. The wintering range of the two populations overlap. Bald eagles occur year-round in Montana (USDA FS 1989; Montana Bald Eagle Working Group (MBEWG) 1986). Their numbers fluctuate between seasons, with the greatest number occurring during spring and fall migration. An estimated 400 to 500 bald eagles winter along major waterways in Montana. Approximately 50 pairs nest in the state during the summer (MBEWG 1986). Important habitat includes wetlands, major water bodies, spring spawning streams, ungulate winter ranges, spring green-up areas, and areas where open water occurs. Important prey appears to be waterfowl, salmonids, suckers, whitefish, carrion, and small mammals.

Nests are generally located within one mile of a water body with adequate food supplies. Most nests are in mature or over-mature dominant or co-dominant trees with open crowns and sturdy horizontal limbs (MBEWG 1986). Live trees are most often selected, and favored species include ponderosa pine, Douglas-fir, and cottonwood. Snags of these species are also used. Nest construction and maintenance occurs during winter months. Eggs are laid between late February and late April. Fledgling normally occurs about mid-July. Intensive surveys of nesting eagles have been carried out by the MBEWG since 1980. Each year since the survey began, the number of nesting eagles have increased.

Wintering bald eagles in Montana are primarily found along major waterways, with some found on upland wintering areas. Roost sites form critical habitat for wintering birds. Roosts consist of large trees or snags and have sturdy lateral limbs near the crown to provide easy entry and exit (USDA FS 1977). These sites are the focal point of bald eagle winter activities and are traditionally used year after year. Some roosts are

used regularly by large or small numbers of eagles, while other receive only occasional use. Wintering eagles in Montana usually arrive about November and leave in March (MBEWG 1986).

Bald eagles have varying tolerances to human disturbance. Disturbance near winter roosts or during egg-laying and incubation at the nest site may result in abandonment of the roost or nest.

Reasons for Decline

The principal causes for population decline has been eggshell thinning resulting from persistent chlorinated hydrocarbon pesticides. Loss of habitat and human disturbance have also been factors in some areas.

Occurrence in Project Area

Intensive surveys of nesting eagles in Montana have been conducted since 1981 (MBEWG 1986). These surveys show nesting eagles along the Yellowstone River but not on the Main Boulder River or its tributaries (Weston et al. 1989). Based on MBEWG criteria, the lower Main Boulder River may contain suitable nesting habitat, but the upper Main Boulder and East Boulder rivers probably do not. These are probably not large enough to provide a dependable supply of prey and they are often closed by ice during late winter when nest building would occur (Weston et al. 1989; Flath, personal communication, 1990). Non-nesting bald eagles, often immature, have been observed along the Yellowstone River during the summer. The number of these birds is increasing rapidly (Flath, personal communication, 1990).

Based on studies in the project area, bald eagles appear to winter along the Main Boulder River and into the lower reaches of the East Boulder River (Beak 1982; USDA FS 1987a; Weston et al. 1989). The furthest upstream sightings were near Anderson Springs, near the GNF boundary. In addition, landowner surveys conducted by Weston Consultants in 1989 found that wintering bald eagles occur along the East Boulder River up to Anderson Springs. Landowners have reported seeing bald eagles nearly every winter in recent years. No regularly used roost sites have been identified. Eagles appear to leave the Main Boulder/East Boulder River area in late February or early March.

Impacts

The potential impacts of this project are the same as those previously identified for the Jackpine Exploration Adit. The bald eagle may be affected by implementation of the East Boulder Mine Project, principally through potential vehicle/bald eagle collisions on the East Boulder Road. During mine operation, traffic volumes have been projected to increase by 593 percent over the estimated use in 1989 on the SG 31 portion of the East Boulder Road, and by nearly 3,000 percent over the estimated use in 1989 on the FS 205 portion of the East Boulder Road. SPGMR will provide bussing for mine employees, but its overall impact on traffic has not yet been determined. The increased mine-related traffic on the East Boulder Road may cause

a larger number of road-killed deer and other mammals since the East Boulder Road crosses through mule deer winter range and white-tailed deer yearlong range. The carcasses provide a food source which may attract bald eagles when they are present in the winter. Bald eagle mortality from collisions or possibly from shooting could result. Potential impacts would likely be greater than for the Jackpine Project, since a larger number of employees would work at the mine, and the project would extend over a longer time period.

Under the preferred alternative, minor losses of general habitat may occur due to road upgrading in riparian areas at seven stream crossings. However, construction in riparian areas is expected to be minor, and no traditional eagle roost sites are known to occur in the area.

The preferred alternative does not include a preferred powerline route between the Duck Creek tap and the existing 161 kV transmission line north of the Yellowstone River. Any of the three alternative routes considered in the draft EIS could potentially impact the bald eagle. Bald eagles currently forage within the area of potential new construction, particularly in riparian habitat. Wintering populations of bald eagles are increasing along the Yellowstone River, but the nearest active nesting site is more than six miles from the nearest proposed area of disturbance. To avoid or reduce potential adverse impacts to the bald eagle, new power poles would be designed and installed to avoid bird electrocution; construction activities would be scheduled during the summer to avoid disturbance to wintering bald eagles; and, to the extent possible, construction would avoid wetlands and riparian zones.

Implementation of conservation measures would reduce potential impacts so they are not likely to adversely affect the bald eagle.

Cumulative Impacts

A number of other projects are proposed for the Gallatin National Forest and nearby areas of the Custer National Forest, including aspen regeneration, browse production improvement, prescribed burning, creation of openings in dense timber, possible beaver reintroduction, timber sales, range improvement burns, and mine exploration programs. These projects are mostly unlikely to have any impact on bald eagles or their habitat in the East Boulder area. Timber sales and mine exploration may involve increased vehicle traffic in bald eagle winter habitat, which would have similar impacts to the East Boulder Mine Project. However, collection of roadkills by SPGMR should effectively reduce the potential for eagle/vehicle collisions, and cumulative impacts are therefore unlikely. No major land disturbance projects are anticipated for the foreseeable future for private lands located in the vicinity of the project area. Most private lands are used for agricultural purposes (mostly livestock raising), and these practices are expected to continue.

Recommended Conservation Measures

The conservation measures required in the agencies' preferred alternative, which include those outlined in the Jackpine Exploration Adit, should also be required for the East Boulder Mine Project, since potential impacts may be the same or possibly greater (considering the larger number of personnel involved). Specific conservation measures for the Jackpine Exploration Adit require SPGMR to have authorized personnel remove roadside carrion daily during the winter months to prevent mortality of bald eagles due to vehicle collisions. In addition, SPGMR must report all collisions with big game animals to a designated company representative who will coordinate with the MDFWP to provide for legal removal by the company representative. Also, SPGMR must ensure employees involved in the project are familiar with the requirements for protection of threatened and endangered species, and continue a policy of discouraging the carrying of firearms. SPGMR has stated they will provide bussing for employees which should help reduce the potential for vehicle/bald eagle collisions on the East Boulder Road.

In addition, all helicopter flights should avoid bald eagle feeding/roosting areas, and pilots should be fully informed of these locations. Disturbed areas near roads should be seeded with species unpalatable to big game to help reduce wildlife road kills, and to reduce the potential for eagles to forage along the roads.

While the project may negatively impact the bald eagle, the recommended conservation measures should reduce possible impacts such that they are not likely to adversely affect the bald eagle.

## 3.2 PEREGRINE FALCON

Status

The American peregrine falcon (Falco peregrinus anatum) is listed as endangered by the U.S. Fish and Wildlife Service, while the arctic peregrine falcon (F.p. tundrius) is listed as threatened.

Distribution and Habitat

The peregrine falcon is a cosmopolitan species of which two subspecies occur in Montana. The American peregrine falcon nests in North America from central Alaska south to central Mexico, and winters as far south as South America. In 1989, six breeding pairs were known to occur in Montana. These are the result of an on-going reintroduction program initiated in Montana in 1981 (Weston et al. 1989). The arctic peregrine falcon nests from northern Alaska east to Greenland and winters south to Central and South America. This species occurs in Montana only during migration (Weston et al. 1989).

Nest sites (eries) are typically located on prominent cliffs over 200 feet high and generally within one mile of water. Peregrines occupy the same nesting territory from year to year. Peregrines feed almost exclusively on birds. They prey on a variety of small-to medium-sized birds including such species as blackbirds, jays, doves, swallows, robins, and Clark's nutcracker, and on waterfowl and shorebirds (USDA FS 1989). Peregrines may travel up to 17 miles from nesting cliffs to hunt. Preferred hunting habitat include cropland, meadows, river bottoms, marshes, and lakes (USFWS 1984). Peregrines usually occupy a nesting site from March to October. Eggs are usually laid in April and the young hatch from mid- to late May. Fledgling occurs from mid-June to mid-July, and the young remain in the area for several weeks after fledgling (USFWS 1984).

Reasons for Decline

Peregrine falcon populations began to decline precipitously throughout the northern hemisphere in the early 1950's, due mainly to reproductive failure resulting from high levels of DDT and its metabolites. Local factors have also included disturbance to nests and shootings. Peregrine falcon are generally intolerant of excessive human activity near the nesting cliff.

Occurrence in Project Area

No peregrine falcons nesting sites are known to occur in the project area. Since 1981, peregrine chicks have been reintroduced by hacking at several selected sites throughout Montana. One such site is located approximately five miles from the East Boulder permit area. In 1989 and 1990, peregrine chicks were hacked and fledged at this site (Weston et al. 1989; Heinrich, personal communication, 1990). There may continue to be hacking at this site in the future, until an adult bird returns to the general area in any given year (average of five years) or a pair establishes an eyrie. Once hacked birds breed successfully, numbers can be expected to increase in that area with seasonal occupancy from about April to September.

A previous study noted potential peregrine falcon feeding habitat in the project area, and potential nesting sites in the cliffs along the Main Boulder River (Beak 1982).

Impacts

The potential impacts of the East Boulder Mine Project are expected to be the same as for the Jackpine Project. The Jackpine Exploration Adit Biological Assessment found that the project might affect peregrine falcon, by interfering with reintroduction of the species at the hack site. The greatest potential impact would be from helicopter disturbance near the hack site or future nesting sites. Helicopter traffic would also occur during the East Boulder Mine Project, and similar impacts could occur.

Peregrine falcons are particularly sensitive to such disturbances during courtship, the early nesting period, and fledgling (Weston et al. 1989). Newly fledged birds may be flushed too far from the hack site when they are inexperienced, making them vulnerable to starvation or predation (USDA FS 1987a). If nesting occurred at this historic site in the future, helicopter traffic could disturb adult birds during courtship and early nesting, or could increase the chances of predation to nesting. Loss of foraging habitat to the project would be minimal. In addition, no significant impacts are anticipated to typical peregrine falcon prey such as songbirds.

The exploration permit issued by Gallatin National Forest for the Jackpine Project required that all helicopter traffic remain at least one mile from the hack site, to minimize potential impacts to peregrine falcons. Construction of the Jackpine adit began in 1990, and no problems have been reported to date. Use of the same conservation measures for this project should be effective in avoiding impacts.

Cumulative Impacts

Other projects proposed for the Gallatin National Forest are unlikely to have effects on peregrine falcon, except where helicopters are used in mineral exploration or for other activities such as timber harvest. Exploration drilling programs have been proposed by Pegasus and Pathfinder in the Big Timber Ranger District of GNF, and by Chrome Corporation (Mouat Mine and Crescent/Iron Mountain Project), International Platinum (Picket Pin Project), Stillwater PGM Resources, and Hjelvik Bluebird Claim Group in the Beartooth District. These projects are mostly located in Independence Mining District on the Main Boulder River, on the East Boulder Plateau, or near the existing Stillwater Mine. None are located near the hack site. In the absence of conservation measures, helicopter traffic supporting some of these exploration programs may occur near the hack site, and have impacts similar to those identified for the East Boulder Mine Project. GNF stipulations against helicopter traffic in the vicinity of the hack site should be effective at preventing adverse cumulative impacts. No major land disturbance activities are anticipated for the foreseeable future on private lands located in the vicinity of the proposed project. Most private land is used for agricultural purposes (mostly livestock raising), and such practices are expected to continue.

Recommended Conservation Measures

The conservation measures required for the agencies' preferred alternative, which include those outlined in the Jackpine Project, should also be required for the East Boulder Mine Project. All helicopter traffic should be required to remain at least one mile away from the hack site, and from any future nesting sites that become established during the life of the project. SPGMR employees should be educated on the status and biology of this species, and the required conservation measures. With these conservation measures, implementation of the project is not likely to adversely affect this species.

## 3.3 GRIZZLY BEAR

### Status

The grizzly bear (Ursus arctos horribilis) is listed as threatened by the U.S. Fish and Wildlife Service for the populations in the continental United States.

### Distribution and Habitat

Historically, the grizzly bear occurred throughout western North America from the Mexican Highlands to north Alaska (Beak 1982; Interagency Grizzly Bear Committee (IGBC) 1987). Today they exist in Alaska, Canada, and a limited portion of the contiguous 48 states. In the contiguous 48 states grizzly bears are found in six ecosystems: the North Cascades in Washington; the Selway-Bitterroot in central Idaho; the Selkirk in the Idaho panhandle; the Cabinet-Yaak in northwestern Montana; the Northern Continental Divide Ecosystem centered in Glacier National Park, Montana; and the Yellowstone Ecosystem centered in Yellowstone National Park, Wyoming. These ecosystems are made up of federal, state, and private land. Gallatin National Forest is included in the Yellowstone Ecosystem.

It is widely believed that grizzly bears in the Yellowstone Ecosystem are expanding their range from the core area within Yellowstone Park (Amato and Whittemore 1989). Gallatin National Forest is included in the area of expansion. While the majority of bear sightings in the forest are near the border with Yellowstone Park, sightings in the Stillwater and Main Boulder River drainages have been increasing over the past 10 years as have grizzly bear/human and grizzly bear/livestock conflicts in the Main Boulder River drainage (Simmons, personal communication, 1990; USDA FS 1987a). No sightings have been reported for the East Boulder River drainage in recent years. Since 1982, the Interagency Grizzly Bear Study Team (IGBST) has maintained a computerized listing of all grizzly bear sightings in the Yellowstone Ecosystem.

Due to the physiology of the grizzly bear, they are able to exploit a wide variety of foods in numerous habitat types (IGBC 1987). They consume both vegetable and animal matter. In the spring, preferred food items include ungulates, rodents, ants, grasses, clover, and horsetail. The preferred cover type includes low-elevation meadows, aspen groves, and Douglas-fir forests (IGBC 1987; Weston et al. 1989). In the summer, grizzlies move to areas where cutthroat trout spawn, if available, and they consume a variety of forbs, roots, berries, and ungulates. Cover types used in the summer include lodgepole pine forests, meadows, and whitebark pine forests. Alpine areas are not favored during summer months (IGBC 1987; Weston et al. 1989). In the fall, grizzlies prefer whitebark nuts if available. Other [illegible] types used in the fall include lodgepole pine forests, aspen groves, and meadows. Annual fluctuatio[illegible] the availability of food, mainly due to variable climatic conditions, influence the habitat type used by the grizzly bear and the distance which they travel to find food. Home range sizes vary from 62 to 555 square miles (USDA FS 1981). Since the closure of the Yellowstone garbage dumps in the mid-seventies, grizzly bear home range

sizes have been increasing, particularly for female bears. The "occupied habitat" for the Yellowstone grizzly includes part of GNF with the boundary running approximately 2 miles south of the Placer Basin permit area (Beak 1982).

Typically, grizzly bears den at high elevations (above 7,800 feet) on timbered north aspects associated with deep snow. Additionally, the dens are isolated, relatively far from developed areas or human activity. Most dens are dug either in sandy loam soils, clay loam soils, or rocky silt soils (Judd et al. 1983).

Reasons for Decline

The decline of the grizzly bear is due to loss of habitat and habitat fragmentation and conflicts with humans (IGBC 1987). In California and the southwestern United States, early stockmen intensively hunted, trapped, and poisoned grizzly bear to protect their livestock and other agricultural activities which resulted in the bear's eventual extinction from these areas. Other human activities which caused further decline of grizzly bear populations include timber harvesting, oil and gas development, and recreational development (IGBC 1987). Currently, various federal and state agencies in the Yellowstone Ecosystem are attempting to recover the grizzly bear population in the area. However, man-caused mortality and reduction in secure habitat are major limiting factors in the recovery of the bear (USDA FS 1987b).

Occurrence in the Project Area

Grizzly bears have not been observed in the East Boulder River drainage in recent times, nor has evidence been found to indicate they reside there (Simmons, personal communication, 1990; USDA FS 1987a). The MDFWP conducted aerial and ground-based wildlife surveys throughout the 1980s in the project area as part of a black bear population study. They did not encounter grizzly bears or signs of grizzly bears during these studies (Weston et al. 1989). Other wildlife surveys conducted by Beak Consultants in 1981 and Weston and Westech Consultants in 1989 also found no evidence of grizzly bears in the project area. However, there have been confirmed grizzly bear sightings in the Main Boulder and Stillwater River drainages during the 1980s, and an unconfirmed sighting in the Elk Creek drainage 5 miles from the project area (Weston et al. 1989). These sightings indicate transient bears may occasionally use the project area.

Two previous studies concluded that the project area contains suitable habitat for the grizzly bear. These conclusions are based on the high level of diversity (a mosaic of riparian habitat, aspen stands, wet and dry meadows, and scattered timber stands) and prime habitat components found in the area (Beak 1982; Weston et al. 1989). One such habitat component is whitebark pine, found on the East Boulder plateau. The seeds from these trees are a favored fall food source for the grizzly, providing both protein and fat for the bears. Many black bears, radio-collared by the MDFWP, are known to feed in this habitat (Simmons, personal communication, 1990; USDA FS 1987a). Due to the variety of habitat, bears could be expected to use the area in the spring, summer, and fall.

In the Forest Plan, the GNF has divided grizzly habitat into five "management situations". The East Boulder River drainage is outside the grizzly bear recovery zone, but is managed as "Management Situation 5" habitat. This classification means grizzlies are considered to "occur only rarely . . . habitat may be suitable and available, but unoccupied . . . and major federal activities probably will not affect the species conservation and recovery." Management of these areas is in accordance with the Interagency Grizzly Bear Guidelines, which state "Grizzly habitat needs are not a necessary consideration. Maintenance of suitable and available but unoccupied habitat is an option."

<u>Impacts</u>

The impacts of the East Boulder Mine Project would be similar to those previously identified for the Jackpine Exploration Adit Project. The East Boulder project would have little impact on the continued existence of the Yellowstone Ecosystem grizzly bear population since there is no evidence of resident grizzlies in the area. However, the project has the potential to directly impact transient grizzlies if they come into the project area. Transient bears could be attracted to the project area if there is a food source, such as garbage, readily available. Grizzly bear/human conflicts could result in grizzly mortality (e.g. from direct shooting). The most likely time for conflicts to occur would be during the construction phase of the project. During this period transient grizzly bears would be unaware of the increased human activity, and conflicts could occur. As mine activity becomes routine, the chances of conflict may be reduced.

Indirect impacts include minor loss of habitat at the permit areas, and loss of isolation due to an increase in human activity. The project would potentially make this area less attractive to transient grizzly bears and possibly slow the movement of grizzlies into currently unoccupied habitat in the Yellowstone Ecosystem. However, the project would not preclude transient bears from using the area, since the amount of habitat disturbed would be small in comparison to the amount available.

Other possible impacts could occur due to conflicts with an increased number of recreationists in the area due to the increased population of mine workers, and from a displacement of recreationists who now use the area and would move to other areas once the mine is in place. This impact is likely to be low since grizzlies do not occur in the area other than occasional transient bears.

The exploration permit issued for the Jackpine Project included several conservation measures designed to minimize adverse impacts to grizzly bears. These included storage of garbage in bear-proof containers, a strict program of control and removal of refuse at all project facilities, measures to make food on site unavailable to bears, a prohibition of firearms at all of the project areas during all project phases, and an employee education program. Construction of the Jackpine Project began in 1990, and no problems with grizzly bears have been reported to date.

Cumulative Impacts

A number of other projects are proposed for the Gallatin National Forest and nearby areas of the Custer National Forest, which could affect present occurrence of transient bears, or future grizzly bear re-occupation of the area. These include aspen regeneration, browse production improvement, prescribed burning, creation of openings in dense timber, possible beaver reintroduction, timber sales, range improvement burns, and mine exploration programs. The various habitat improvement projects may increase the potential for grizzly bear occurrence, while human activity associated with exploration drilling programs and timber harvest may disturb transient bears. No major land disturbance projects are anticipated for the foreseeable future on private lands located in the vicinity of the project area. The majority of private lands are used for agricultural purposes (mostly livestock raising) and these activities are expected to continue. Overall, with the exception of the East Boulder Mine Project, the various projects in the area do not represent a major increase in human activity and are unlikely to have significant cumulative effects on either transient grizzly bears or future grizzly bear re-occupation of the area.

Recommended Conservation Measures

The conservation measures required for the agencies' preferred alternative, which include those outlined in the Jackpine Project, should also be required for the East Boulder Mine Project. With these conservation measures, the project is not likely to adversely affect the grizzly bear.

### 3.4 DETERMINATION OF EFFECT

The proposed East Boulder Mine Project has the potential to impact all three of the listed species which could occur in the area. The project may increase the potential for bald eagle/vehicle collisions, reduce the effectiveness of the peregrine falcon reintroduction plan, and reduce the expansion of the grizzly bear into the area. However, a "not likely to adversely affect" determination has been made dependent upon implementation of the above-mentioned conservation measures. Written concurrence from the U.S. Fish and Wildlife Service is required for the "not likely to adversely affect" determination.

The Gallatin National Forest has identified several sensitive species, both plant and animal, which occur or could occur on the forest. Two of these sensitive species, yellow springbeauty (Claytonia lanceolata var. flava) and Yellowstone cutthroat trout (Salmo clarki bouvieri), are known to occur in or around the project area. In addition, the East Boulder River is considered favorable habitat for the harlequin duck (Histrionicus histrionicus). The list of Gallatin National Forest sensitive species includes the following:

**FISH AND WILDLIFE**

- Westslope cutthroat trout
- Yellowstone cutthroat trout
- Trumpeter swan
- Harlequin duck
- Boreal owl
- Common loon
- Ferruginous hawk
- Western big-eared bat
- Spotted bat

**PLANTS**

- Jackson's Hole thistle (Cirsium subniveum)
- Yellow springbeauty (Claytonia lanceolata var. flava)
- Giant helleborine (Epipactis gigantea)
- Discoid goldenweed (Haplopappus macronema var. macronema)
- Large-fruited kobresia (Kobresia macrocarpa)
- Jove's buttercup (Ranunculus jovis)
- Barratt willow (Salix barrattiana)
- Wolf's willow (Salix wolfii var. wolfii)
- Alpine meadowrue (Thalictrum alpinum)

## 4.1 SENSITIVE SPECIES KNOWN OR LIKELY TO OCCUR IN THE PROJECT AREA

The following Gallatin National Forest Sensitive Species are known or are likely to occur in or around the project area.

Yellow Springbeauty

A small, white-flowered form of yellow springbeauty (Claytonia lanceolata var. flava) occurs at the East Boulder permit area, including specific areas which would be disturbed by development. Field surveys conducted during June 1990, revealed large numbers of yellow springbeauty at the permit area; other populations have been identified throughout the East Boulder and West Boulder River drainages. The taxonomy of this plant is currently under review, specifically with regard to flower color and leaf morphology. This variety has been recognized as one of several species, primarily based on yellow flower color. However, morphological and genetic studies completed to date suggest that the variety is distinct at the full species level, and can itself be either yellow- or white-flowered. It is unlikely that the taxonomic evaluation will be finalized by botanists before this biological assessment is finalized; however, at this time the Claytonia at the project site is tentatively identified as the white-flowered form of Claytonia lanceolata var. flava.

Clearing and grading at the East Boulder permit area would eliminate on-site populations of this plant, but other nearby populations would not be impacted. The preferred alternative identified by the agencies included as a conservation measure a distribution survey to determine the need and the measures necessary to protect yellow springbeauty populations in the project area.

Yellowstone Cutthroat Trout

Yellowstone cutthroat trout were stocked at Placer Basin on the upper East Boulder River in 1971 (Poore, personal communication, 1990). The steep gradient of the East Boulder River has prevented other trout species from penetrating this area. In August of 1989, 29 trout from this population were collected from the head of the East Boulder River above Picket Pin Road for genetic purity analysis. Careful electrophoretic examination of fish muscle, eye, and liver tissue showed the fish to be genetically pure Yellowstone cutthroat trout (Weston et al. 1989). Genetically pure Yellowstone cutthroat trout were also found in the East Boulder River about one-half to three-quarters mile downstream of the mouth of Brownlee Creek, during studies in 1990 (Zubik 1990). This population is separated by a steep barrier falls from a mixed-species population in the East Boulder River about one mile below the month of Brownlee Creek.

Impacts to pure Yellowstone cutthroat trout are expected to be minimal because they are upstream of almost all major development. However, the Brownlee Creek permit area is adjacent to the portion of the river where the fish occur, but minimal impacts are expected because of the small size of the permit area (less than 3 acres will be disturbed), the lack of a road accessing the permit area, and the coarse, non-erosive substrate in the East Boulder River at that location.

Harlequin Duck

Field surveys for the harlequin duck were conducted on the Gallatin National Forest in 1990 (Markum 1990). Harlequin ducks are known to prefer isolated, swift-flowing mountain streams for breeding. They winter on the coasts, mainly in the Aleutians. The 1990 study of distribution and abundance of the species on the Gallatin National Forest included all of the potential harlequin duck breeding habitat identified on the forest. Harlequin duck were only recorded on the upper Main Boulder River, about ten miles southwest of the East Boulder permit area which appears to be the edge of the known range. Harlequin duck were not observed on the East Boulder River during this study, and have not been previously observed there. However, the study indicated that this river appeared to be the best candidate for occurrence of the 14 streams surveyed, because of its habitat features and absence of a road or trail running along its length. While the proposed mine project is expected to impact the East Boulder river, particularly in the vicinity of the East Boulder permit area (e.g. possible increase in sediments and possible increase and/or reduction in flows), no adverse impacts to downstream beneficial uses or channel patterns are anticipated. Therefore, the favorable harlequin duck habitat features would not be impacted.

If the harlequin duck were to use the area, no impacts resulting from the project are anticipated.

## 4.2 SENSITIVE SPECIES NOT FOUND IN THE PROJECT AREA

Several species listed a sensitive by the Gallatin National Forest do not occur in the project area due to unsuitable habitat conditions, and therefore would not be impacted by the project. These include the following.

Trumpeter Swan

Trumpeter swans nest on the margins of interconnected shallow marshes and lakes, lakes with forested or sagebrush habitat, and oxbow habitat along rivers. They nest in secluded areas and often use the site for several years. These large birds need sufficient amounts of open water for landing and take off. They are known to use the Hebgen Lake District of the Gallatin National Forest during migration, but none are presently known to nest on the forest.

Westslope cutthroat trout

Westslope cutthroat trout occurs in clear, cool streams usually with water temperatures under 60 F. It's habitat contains rocky, silt-free riffles for spawning and slow, deep pools for feeding and resting. They tend to occupy river headwaters and cold, clear, deep lakes with tributary streams suitable for spawning. Westslope cutthroat trout are native to the Missouri and Upper Columbia Rivers in Montana. They occur on the Gallatin National Forest, but none are known to occur on the East Boulder River or its tributaries.

Arctic Graying

Fluvial (stream dwelling) arctic grayling are not native to the Yellowstone River drainage. They are found in the upper Bighole River drainage in Montana. They do not occur in the project area.

Ferruginous Hawk

Ferruginous hawks inhabit unbroken native prairie grasslands, plains, and badlands. They appear to have an affinity for areas with sparse or short vegetation. Usually, they nest on the ground on low hillsides, ridgetops, or buttes. They are widely distributed throughout Gallatin National Forest, but none are known to occur in the project are (Simmons, personal communication, 1991).

Boreal Owl

Boreal owls live year-round in high elevations (5,000 to 8,000 feet), in mature-to-old growth Engelmann spruce and subalpine fir forests. According to U.S. Forest Service timber data, this type of habitat is not present in or around the proposed project area (Timko 1990).

Common Loon

Common loons nest on clear, secluded lakes larger than 10 to 13 acres in size. They appear to avoid lakes above 5,000 feet in elevation, which are often unproductive, or covered with ice until the late spring or early summer.

Western Big-eared Bat

The western big-eared bat has been recorded in a variety of habitats ranging from dry pinyon-juniper woodland to high elevation mixed conifer forests. They roost communally in large aggregations in caves and abandoned mine tunnels, and are extremely sensitive to human disturbance. Since their known distribution includes the study area, helicopter surveys to locate caves in or near the permit areas were made by GNF in 1990, but no natural caves were observed.

Spotted Bat

Relatively little is known about the life history of the spotted bat. They have most often been trapped in dry, rough, desert terrain. They also occur in dry canyon areas with high limestone cliffs that provide roost sites. Their preferred feeding areas are near water where they feed on insects. The spotted bat is suspected to occur in the Gallatin National Forest, but none have been found.

Jackson's Hole Thistle

Jackson's Hole thistle is found in sagebrush grasslands and meadows in the mountains from 6,000 to 8,000 feet elevation. It's area of distribution includes southwestern Montana. There are no known occurrences of this plant on the Gallatin National Forest.

Giant Helleborine

Giant helleborine is limited to such areas as streambanks, lake margins, springs, and seeps that have warm water. These seeps occur at 2,900 to 4,100 feet in elevation. No known individuals occur on the Gallatin National Forest.

Discoid Goldenweed

Discoid goldenweed is generally found at high elevations (7,600 feet), often above timberline on sparsely wooded slopes, rocky slopes, or in coarse talus. The project area does not contain suitable habitat for this species, and no known individuals occur on the Gallatin National Forest.

Large-fruited Kobresia

Large-fruited kobresia is most commonly found in the arctic region, but some populations are known to occur in south-central Montana and the surrounding area at elevations of approximately 9,800 feet. Typical habitat is moist tundra or gravelly lakeshores. No known individuals occur on the Gallatin National Forest.

Jove's Buttercup

Jove's buttercup is typically found on sagebrush slopes to open areas in spruce-fir parklands at mid to high elevations. This species is known to occur on the Gallatin National Forest, but field surveys showed no individuals are present in the project area.

Barratt's Willow

Barratt's willow is found in alpine areas between 6,800 to 10,500 feet in elevation. The only known occurrences of this species are in the Beartooth Mountains on the Custer National Forest and in Glacier National Park.

Wolf's Willow

Typical habitat for Wolf's willow is streambanks and wet meadows in upper montane and subalpine areas at elevations of 8,000 to 9,000 feet. The closet known occurrence is west of the project area in the Beaverhead and Deerlodge National Forests.

Alpine Meadowrue

Alpine meadowrue occurs on hummocky ground in moist, alkaline meadows at elevations between 6,500 and 7,000 feet. It is often found beneath shrubby cinquefoil. No known individuals occur on the Gallatin National Forest.

## 5.1 INDIVIDUALS CONTACTED

Dennis Flath. Non-game biologist, Montana Department of Fish, Wildlife and Parks, Bozeman, MT.

Steve Fritts. Endangered Species biologist, U.S. Fish and Wildlife Service, Helena, MT.

Bill Heinrich. Raptor biologist, Peregrine Fund, Boise, Idaho.

Kemper McMaster, Field Supervisor, Montana-Wyoming Field Office, U.S. Fish and Wildlife Service, Helena, MT.

Jan Nixon. Botanist, Montana Natural Heritage Program, Helena, MT.

Mike Poore. Fish Biologist, Montana Department of Fish, Wildlife and Parks, Columbus, MT.

Claire Simmons. Area Wildlife biologist, Montana Department of Fish, Wildlife and Parks, Big Timber, MT.

Ray Zubik. Big Timber District biologist, Gallatin National Forest, Big Timber, MT.

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Fritts, S. 1990. Endangered Species biologist, U.S. Fish and Wildlife Service. Personal Communication to E. Lack, Woodward-Clyde Consultants.

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# ENDANGERED SPECIES COMPLIANCE LETTERS

2670

Kemper McMaster
Field Supervisor
Montana/Wyoming Field OFfice
US Fish and Wildlife Service
Federal Building
P.O. Box 10023
Helena, Montana 59626

Dear Mr. McMaster:

The Gallatin National Forest would like to request a list of federally listed threatened or endangered species which should be considered in the Biological Assessment to be written for the East Boulder Mine. Woodward and Clyde, a consulting firm located in Denver, will be writing the Biological Assessment for this project.

The project area for the East Boulder Mine, proposed by Stillwater PGM Resources, would be located 30 miles south of Big Timber, Montana in the East Boulder River drainage. The proposed mine would be very similar to the operating Stillwater Mine at Nye, Montana. The East Boulder Project proposal consists of an underground platinum and palladium mine and associated milling facilities. The location of the majority of the surface facilities are within portions of Sections 2,3,11,19,26,28,29, and 34, T4S, R13E. The plan also calls for mine and ventilation openings on the surface above the ore zone which would embrace portions of Sections 19,20,27,28,29,33,34, and 35, T4S, R13E. Mine life is estimated at about 25 years. Workforce requirements are estimated at 600+ employees.

We appreciate the good working relationship that we maintain, both formally and informally, with your staff. Thank your for your assistance.

Sincerely,

ROBERT S. GIBSON
Forest Supervisor

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

IN REPLY REFER TO:

M. 19 Gallatin NF/Stillwater PGM Resources

September 24, 1990

Robert S. Gibson, Forest Supervisor
Gallatin National Forest
P.O. Box 130
Bozeman, MT 59771

Dear Mr. Gibson:

This is in response to your letter of August 28, 1990 regarding the proposed Stillwater PGM Resources platinum and palladium mine in the East Boulder River drainage on the Gallatin National Forest in Sweet Grass County, Montana. Your letter was received by the Fish and Wildlife Service, Montana/Wyoming Field Office on August 29, 1990.

In accordance with Section 7(c) of the Endangered Species Act of 1973, as amended (ESA), we have determined that the following listed and proposed threatened or endangered (T/E) species may be present in the project area.

| Listed Species | Expected Occurrence |
|---|---|
| Threatened grizzly bear (*Ursus arctos horribilis*) | Transient. |
| Endangered bald eagle (*Haliaeetus leucocephalus*) | Migrant. Summer resident. Winter use. |
| Endangered peregrine falcon (*Falco peregrinus*) | Migrant. Potential nesting. |

Proposed Species

None.

Section 7(c) of ESA requires that Federal agencies proposing major construction activities complete a biological assessment to determine the effects of the proposed actions on listed and proposed species and use the biological assessment to determine whether formal consultation is required. If a biological assessment is not required (i.e. all other actions), the Federal agency is still required to review their proposed activities to determine whether listed species may be affected. If such a determination is made, formal consultation with the Fish and Wildlife Service (Service) is required.

For those actions wherein a biological assessment is required, it should be completed within 180 days of initiation, but can be extended by mutual agreement between the Federal agency or its designated non-Federal representative and the Service. If the assessment is not initiated within 90 days, the list of T/E species should be verified with the Service prior to initiation of the assessment. The biological assessment may be undertaken as part of the Federal agency's compliance of Section 102 of the National Environment Policy Act (NEPA) and incorporated into the NEPA documents.

We recommend that biological assessments include the following:

1. A description of the project,

2. A description of the specific area that may be affected by the action,

3. The current status, habitat use, and behavior of T/E species in the project area,

4. Discussion of the methods used to determine the information in Item 2,

5. An analysis of the affects of the action on listed species and proposed species and their habitats, including an analysis of any cumulative effects,

6. Coordination/mitigation measures that will reduce/eliminate adverse impacts to T/E species,

7. The expected status of T/E species in the future (short and long term) during and after project completion,

8. A determination of "is likely to adversely affect" or "is not likely to adversely affect" for listed species,

9. A determination of "is likely to jeopardize" or "is not likely to jeopardize" for proposed species.

10. Citation of literature and personal contacts used in developing the assessment.

If it is determined that the proposed program or project "is likely to adversely affect" any listed species, formal consultation should be initiated with us. If it is concluded that the project "is not likely to adversely affect" listed species, we should be asked to review the assessment and concur with the determination of no adverse effect.

A Federal agency may designate a non-Federal representative to conduct informal consultation or prepare biological assessments. However, the ultimate responsibility for Section 7 compliance remains with the Federal agency and written notice should be provided to the Service upon such a designation. We recommend that Federal agencies provide their non-Federal representatives with proper guidance and oversight during preparation of biological assessments and evaluation of potential impacts to listed species.

Section 7(d) of ESA requires that the Federal agency and permit/license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation or reasonable and prudent alternatives until consultation on listed species is completed.

If you have any questions regarding this matter you may contact Scott Jackson, of my staff, in our Helena Office at (406) 449-5225 or FTS 585-5225.

Sincerely,

for Kemper M. McMaster
Field Supervisor
Montana-Wyoming Field Office

SDJ/ndg
(B:GIBSON.LTR)

United States Department of Agriculture
Forest Service
Gallatin National Forest
P.O. Box 130
Bozeman, MT 59771

Reply to 2670

Date: JAN 3 1991

Kemper McMaster, Field Supervisor
Montana/Wyoming Field Office
US Fish and Wildlife Service
Federal Building
P.O. Box 10023
Helena, MT 59626

Dear Mr. McMaster:

In a letter dated August 27, 1990, The Gallatin National Forest requested a list of federally listed species which should be considered in the Biological Assessment to be written for the East Boulder Mine. Your office responded to this request on September 24, 1990.

It has recently come to my attention, however, that the location of the project for the mine and mine related facilities was not described adequately because a needed powerline was not taken into account. I have attached two maps, one showing the East Boulder Project (Fig. 1.1-1) and one showing the proposed powerline corridors (Fig. 2.4-3). As you can see, the area affected by the powerline extends north of the Yellowstone River and up the west side of the Main Boulder. Some of this powerline activity consists of upgrading an existing powerline (south of the Yellowstone River) and installation of new powerline (north of the Yellowstone).

If you believe we need to address federally listed species other than those mentioned in your letter of September 24th, please let me know as soon as possible. I would also appreciate clarification on whether and how to address species with federal candidate status.

Thank you for your assistance in this matter.

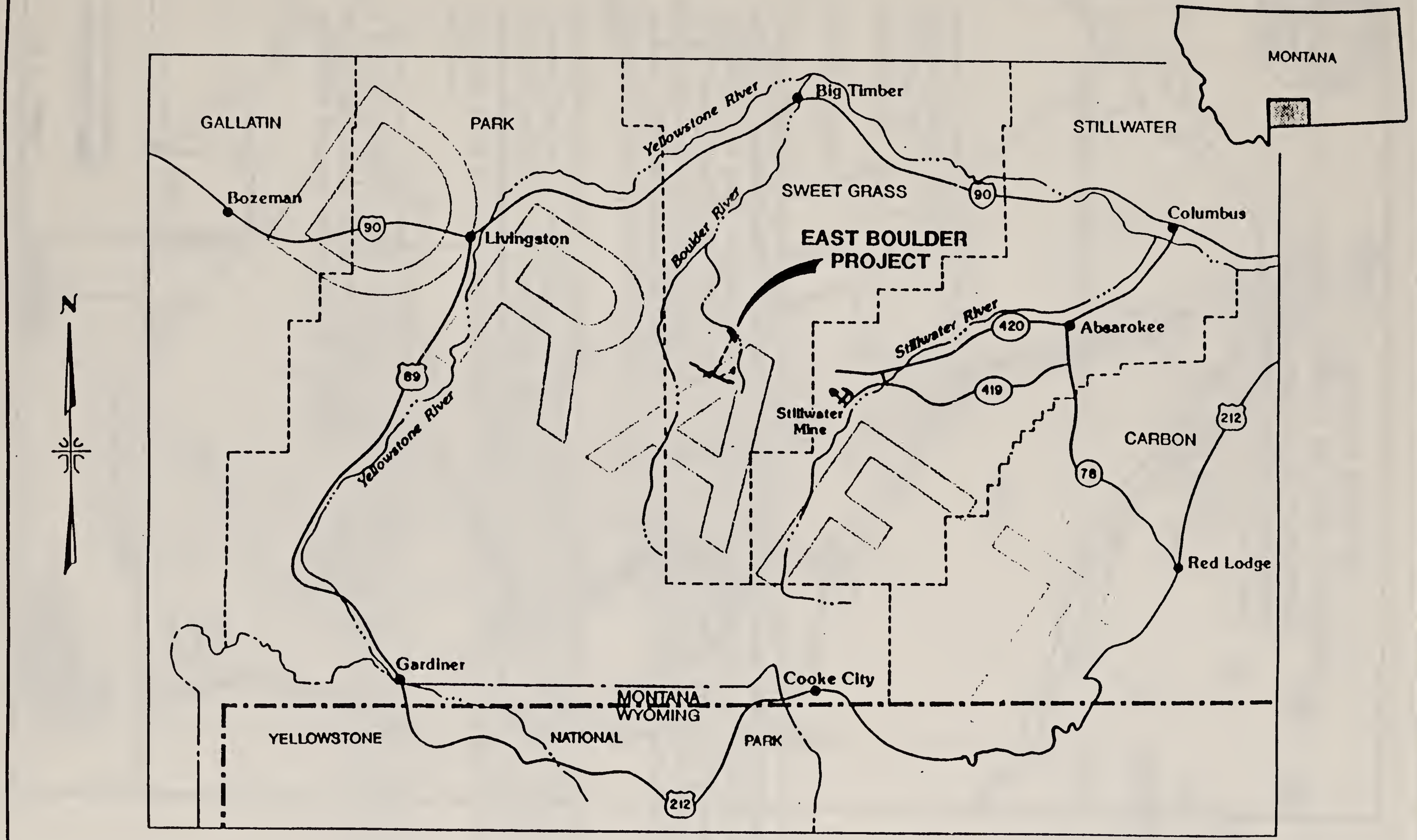
Sincerely,

Leonard L. Lucero

LEONARD L. LUCERO
Acting Forest Supervisor

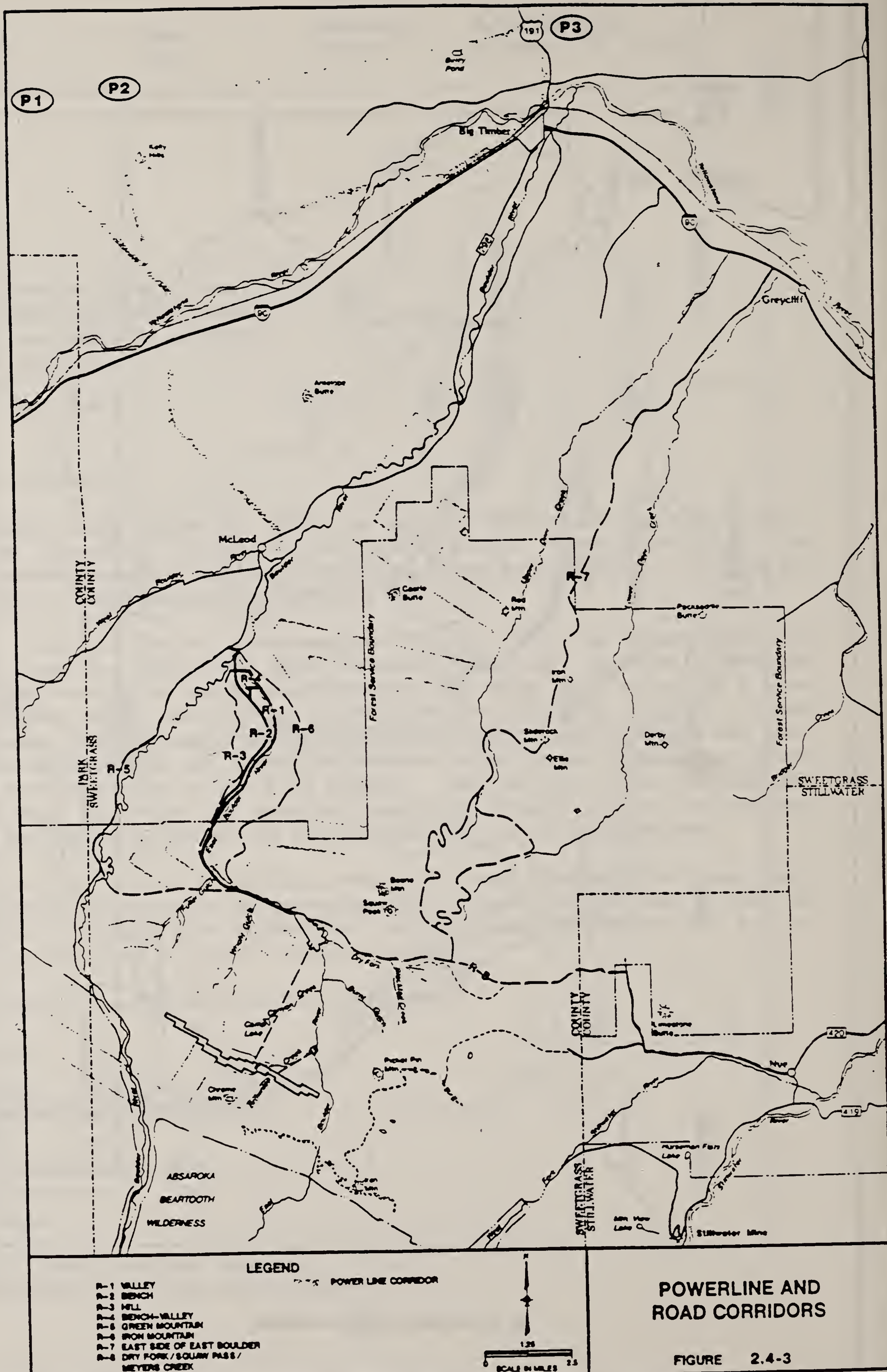
Enclosures

cc: B. Timko, District Ranger
Woodward and Clyde Consultants




VICINITY MAP

Figure 1.1-1




POWERLINE AND ROAD CORRIDORS

FIGURE 2.4-3

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

IN REPLY REFER TO:

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JAN 1 8 1991
WCC/DENVER, COLORADO

M.19 Gallatin NF/Stillwater PGM Resources

January 16, 1991

Leonard L. Lucero, Acting Forest Supervisor
Gallatin National Forest
P. O. Box 130
Bozeman, MT 59771

Dear Mr. Lucero:

This is in response to your letter of January 3, 1991 regarding the list of threatened and endangered species likely to be present in the area of the East Boulder Mine project that was provided by this office on September 24, 1990. This list was comprised of the threatened grizzly bear (Ursus arctos horribilis) and the endangered bald eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrinus). In your letter you indicated the possible need to add species to that list because a description of the proposed powerline corridor associated with this project was not included in the original species list request.

Based upon a review of the proposed powerline location and conversations with Fish and Wildlife Service (Service), Forest Service and Montana Department of Fish, Wildlife and Parks wildlife biologists familiar with the project area and threatened and endangered species distribution in Montana, the Service has determined that no threatened or endangered species other than those previously listed are likely to be present in the area of the East Boulder Mine and associated facilities.

Your letter also requested clarification on whether and how to address federal candidate species in the biological assessment for this project. This subject requires discussion with members of my staff who are out of the office until January 23, 1991. Therefore, I will send you a separate letter after that date addressing this matter.

If you have further questions or concerns regarding this project, please contact Scott Jackson, of my staff, in our Helena office at (406)449-5225 or FTS 585-5225.

Sincerely,

Ronald L. Crete

for Kemper M. McMaster
Field Supervisor
Montana/Wyoming Field Office

SDJ/sdj

cc: Bill Timko, District Ranger, Gallatin National Forest, Big Timber Ranger District, P. O. Box A, Big Timber, MT 59011

Jeff Dawson, Woodward-Clyde Consultants, Stanford Place 3, Suite 1000, 4582 South Ulster Street Parkway, Denver, CO 80237

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

RECEIVED
MAY 01 1991
NOC/DENVER

IN REPLY REFER TO:

M.19 Gallatin NF/Stillwater PGM Resources

January 30, 1991

Leonard L. Lucero, Acting Forest Supervisor
Gallatin National Forest
P. O. Box 130
Bozeman, MT 59771

Dear Mr. Lucero:

As indicated in my January 16, 1991 letter to you, I am now responding to your earlier request for clarification on whether and how to address Federal candidate species in the biological assessment for the East Boulder Mine project on the Gallatin National Forest. Pursuant to S402.12 (d) of the 50 CFR, when a Federal agency requests a list of listed or proposed threatened or endangered species, or designated or proposed critical habitat, the Fish and Wildlife Service (Service) shall additionally provide the requesting agency with a list of candidate species that may be present in the action area. Candidate species refer to any species being considered by the Service for listing as endangered or threatened but which has not yet been the subject of a proposed rule. Inclusion of candidate species on this list serves to inform the Federal agency of the potential for proposals for listing. While it is prudent to take candidate species into account during project planning, they have no legal status and are accorded no legal protection under the Endangered Species Act, as amended. Thus, the Federal agency need not include them in a biological assessment.

Our Regional policy has been to include only Category 1 candidate species when we receive requests for species lists. Category 1 includes species for which substantial information is available to support the biological appropriateness for proposing to list the species. There are currently two Category 1 species in Montana, the Montana Arctic grayling (Thymallus arcticus montanus) and water howellia (Howellia aquatilis), neither of which are known to occur on the Gallatin National Forest. Therefore, you need not address any candidate species in biological assessments for projects on the Gallatin National Forest. You will be notified if the status of any Category 2 candidate species known to occur on the Gallatin National Forest changes to Category 1.

Please contact Scott Jackson, of my staff, in our Helena office at (406)449-5225 or FTS 585-5225 if we can be of further assistance. Your cooperation in meeting our joint responsibilities under the Endangered Species Act is appreciated.

Sincerely,

Kemper M. McMaster
Field Supervisor
Montana/Wyoming Field Office

SDJ/sdj

# GALLATIN NATIONAL FOREST

## SENSITIVE SPECIES LIST (as of 12/90)

### FISH AND WILDLIFE

Westslope cutthroat trout
Yellowstone cutthroat trout
Trumpeter swan
Harlequin duck
Boreal owl
Common loon
Ferruginous hawk
Western big-eared bat
Spotted bat

### PLANTS

Jackson's Hole thistle (*Cirsium subniveum*)
Yellow springbeauty (*Claytonia lanceolata* var. *flava*)
Giant helleborine (*Epipactis gigantea*)
Discoid goldenweed (*Haplopappus macronema* var. *macronema*)
Large-fruited kobresia (*Kobresia macrocarpa*)
Jove's buttercup (*Ranunculus jovis*)
Barratt willow (*Salix barrattiana*)
Wolf's willow (*Salix wolfii* var. *wolfii*)
Alpine meadowrue (*Thalictrum alpinum*)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Federal Bldg., U.S. Courthouse
301 South Park
P.O. Box 10023
Helena, Montana 59626

IN REPLY REFER TO:

RECEIVED
JAN 1 8 1991
WCC/DENVER, COLORADO

M.19 Gallatin NF/Stillwater PGM Resources

January 16, 1991

Leonard L. Lucero, Acting Forest Supervisor
Gallatin National Forest
P. O. Box 130
Bozeman, MT 59771

Dear Mr. Lucero:

This is in response to your letter of January 3, 1991 regarding the list of threatened and endangered species likely to be present in the area of the East Boulder Mine project that was provided by this office on September 24, 1990. This list was comprised of the threatened grizzly bear (Ursus arctos horribilis) and the endangered bald eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrinus). In your letter you indicated the possible need to add species to that list because a description of the proposed powerline corridor associated with this project was not included in the original species list request.

Based upon a review of the proposed powerline location and conversations with Fish and Wildlife Service (Service), Forest Service and Montana Department of Fish, Wildlife and Parks wildlife biologists familiar with the project area and threatened and endangered species distribution in Montana, the Service has determined that no threatened or endangered species other than those previously listed are likely to be present in the area of the East Boulder Mine and associated facilities.

Your letter also requested clarification on whether and how to address federal candidate species in the biological assessment for this project. This subject requires discussion with members of my staff who are out of the office until January 23, 1991. Therefore, I will send you a separate letter after that date addressing this matter.

If you have further questions or concerns regarding this project, please contact Scott Jackson, of my staff, in our Helena office at (406)449-5225 or FTS 585-5225.

Sincerely,

for Kemper M. McMaster
Field Supervisor
Montana/Wyoming Field Office

SDJ/sdj

cc: Bill Timko, District Ranger, Gallatin National Forest, Big Timber Ranger District, P. O. Box A, Big Timber, MT 59011

Jeff Dawson, Woodward-Clyde Consultants, Stanford Place 3, Suite 1000, 4582 South Ulster Street Parkway, Denver, CO 80237

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Helena, Montana 59626

RECEIVED
MAY 0 1 199?
NCC/DENVER

IN REPLY REFER TO:

M.19 Gallatin NF/Stillwater PGM Resources

January 30, 1991

Leonard L. Lucero, Acting Forest Supervisor
Gallatin National Forest
P. O. Box 130
Bozeman, MT 59771

Dear Mr. Lucero:

As indicated in my January 16, 1991 letter to you, I am now responding to your earlier request for clarification on whether and how to address Federal candidate species in the biological assessment for the East Boulder Mine project on the Gallatin National Forest. Pursuant to S402.12 (d) of the 50 CFR, when a Federal agency requests a list of listed or proposed threatened or endangered species, or designated or proposed critical habitat, the Fish and Wildlife Service (Service) shall additionally provide the requesting agency with a list of candidate species that may be present in the action area. Candidate species refer to any species being considered by the Service for listing as endangered or threatened but which has not yet been the subject of a proposed rule. Inclusion of candidate species on this list serves to inform the Federal agency of the potential for proposals for listing. While it is prudent to take candidate species into account during project planning, they have no legal status and are accorded no legal protection under the Endangered Species Act, as amended. Thus, the Federal agency need not include them in a biological assessment.

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Sincerely,

Kemper M. McMaster
Field Supervisor
Montana/Wyoming Field Office

SDJ/sdj

GALLATIN NATIONAL FOREST



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